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INTERMITTENT VENOUS OCCLUSION IN PERIPHERAL VASCULAR DISEASE *

Study of Its Physiologic Mechanism and Therapeutic Effects

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and
HYMAN GINSBERG

BROOKLYN, NEW YORK

The problem of increasing the vascular capacity of an extremity in which mechanical impairment in circulation arises from obliterative arterial disease is one which taxes the ingenuity of clinical investigators. One must realize that any attempt at reconstructing this mechanical impairment cannot be by way of recreating the patency of organically occluded arteries but can only be approached by influencing vasospasm and the collateral circulation. The collateral circulation is nature's method of shunting blood flow to protect a limb against destruction. This is true in cases of organic obliterative arterial disease. There are, however, many patients who suffer from impairment arising from partial obliteration. This state of partial obstruction is frequently influenced by two factors, first, encroachment upon the lumen of the vessel by organic alterations in the wall of the vessel and second, the added factor of vasospasm. The chief problem in treatment therefore, becomes one of creating maximal states of vasodilatation both of the main arterial pathways and their collaterals. The conservative non-operative methods outlined to influence the circulation may be generally classified into two large groups: one, chemical, and two, physical. The chemical methods consist largely of the administration of antispastic or vasodilating drugs such as alcohol, salicylates, xanthines, calcium, parathormone, acetylcholine and various tissue extracts. The physical methods include superficial and deep heat by baking, diathermy and warm baths, and alterations in environmental pressure of a limb by the creation of alternate suction and pressure.

We have recommended a mechanical method which is based upon definite physiologic laws[1]. Hyperemia produced by venous stasis is well known as Bier's hyperemia[2]. Lewis[3] in studying the mechanism which would explain the therapeutic basis of Bier's hyperemia observed in his experiments that after the release of venous congestion there occurred an increase in arterial flow much out of proportion to the original control flow. He found that this state of reactive hyperemia is definitely influenced and proportional to the amount of congesting pressure, the duration of pressure and the environmental temperature of the limb. He observed that in the normal when the congesting pressure is elevated to 90 mm. of mercury for 15 minutes at 40 C., arterial flow during the state of reactive hyperemia would increase as much as 600 per cent (fig. 1, table 1).

It appeared obvious to us that if we created intermittent periods of venous congestion that we would then be producing alternating states of Bier's hyperemia and Lewis' reactive hyperemia. We therefore constructed

* From the Department of Metabolism and Internal Medicine, Israel Zion Hospital.
* Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 24, 1937.

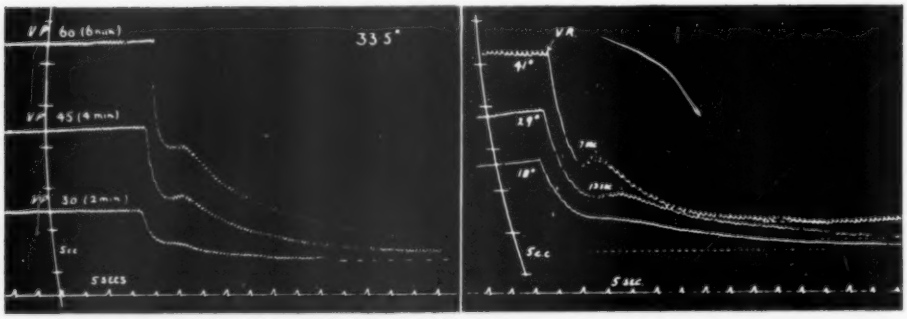


Fig. 1. — Plethysmographic tracings taken from Lewis and Grant (see references) to show intensity of reactive hyperemia directly proportional to duration and amount of congesting pressure and environmental temperatures. The table (1) gives the figures pertaining to the actual increase in arterial flow during reactive hyperemia.

TABLE 1. — *Inflow to Arm 5 Seconds After Release of Venous Congestion**

	Blood pressures and temp.	Congesting pressure	Inflow to 100 c.c. tissue per min.	Normal inflow to 100 c.c. tissue per min.
T. L.	120/85	90 for 1 min.	16.5 c.c.	10 c.c.
March 4th	temp.	90 " 5 "	41.4 "	
	33.5°	90 " 10 "	57.9 "	
T. L.	120/90	70 " 10 "	46.6 "	15-16 c.c.
March 14th	temp.	60 " 10 "	35.9 "	
	36°	50 " 15 "	41.6 "	
R. G.	118/88	80 " 15 "	36.1 "	7-10 c.c.
March 16th	temp.	70 " 15 "	24.8 "	
	36°	60 " 15 "	21.0 "	
		50 " 15 "	14.2 "	
T. L.	125/88	50 " 15 "	22.0 "	10-12 c.c.
March 19th	temp.	60 " 15 "	26.4 "	
	36°	70 " 15 "	30.8 "	
		80 " 15 "	44.0 "	

* Reproduced from paper by Lewis and Grant.

an automatic apparatus with which to produce intermittent periods of venous compression through a pneumatic cuff (fig. 2) applied to the proximal portion of the diseased extremity and in which we were able to control the amount of pressure, duration of pressure and the period of its release.

We have up to this time treated 137 cases of peripheral vascular disease. Those cases that had open lesions, whether gangrene or ulcer, were put to bed, a cradle baker was applied to the extremity and maintained at approximately 95 F. by the use of a 25 watt lamp, and intermittent venous occlusion was given at 30-40 mm., one minute on and two minutes off continuously day and night. After three days, treatment was reduced to approximately 8 to 10 hours a day. In cases where no open lesions existed pressures as high as 60 to 80 mm. were given for alternating periods of two minutes continuously.

Results of Treatment

The results indicate that we have afforded prompt relief of rest pain in a great majority of our cases. Intermittent claudication has been greatly improved, so that patients have increased their walking capacity five to ten times the distance they were originally able to walk before claudication developed. The nutritional condition of the tissues has improved, as evidenced by growth of hair and acceleration in the growth of nails. Ulcers and gangrenous lesions have healed which have not responded to other forms of therapy (table 2, figs. 3, 4; table 3; table, 4, figs. 5, 6; table 5).

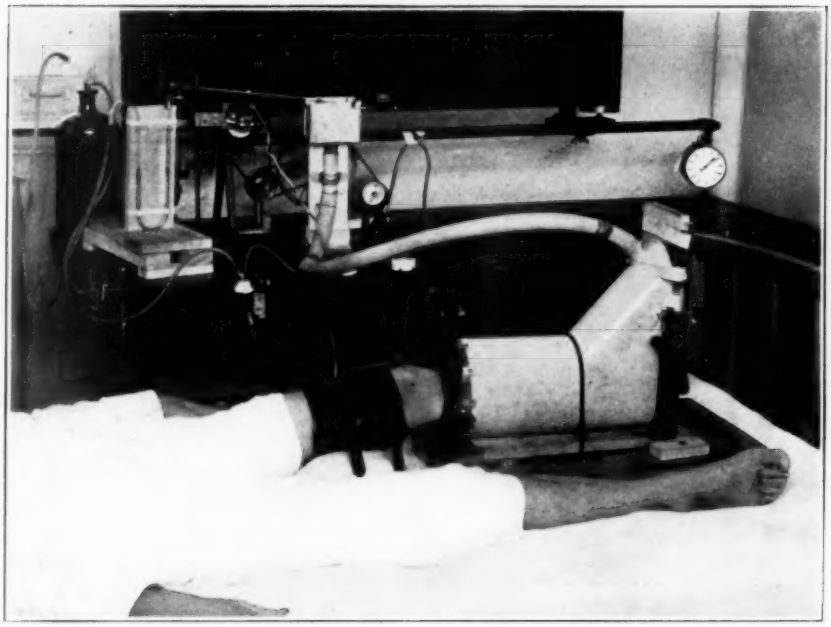


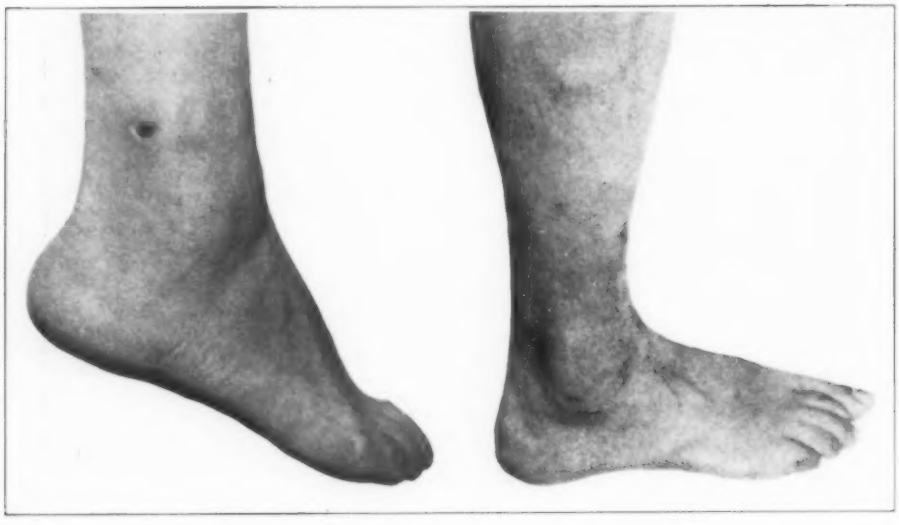
Fig. 2. — Illustration of plethysmographic apparatus with the extremity in the boot and the pneumatic cuff applied to the thigh.

TABLE 2. — *Summary of 31 Cases of Thromboangiitis Obliterans*

	No. Cases	Per Cent Healed
Ulcers or Gangrene	21	
Completely healed	13	62
Healing	6	29
Amputation	2	9
Healed and subsequently broken down	3	....
	No. Cases	**Per Cent Completely Relieved**
Rest Pain	34	
Complete relief in 48 hrs.	28	83
Partial relief	3	....
No relief	1	....

We also have evidence that there has been a definite improvement in the flow of arterial blood by increase in the surface temperature of toes and improvement in oscillometric readings. But most important of all is the evidence which we have accumulated in our plethysmographic studies that the method of treatment has resulted in definite increases of vascular capacity and rate of arterial flow. These plethysmographic investigations, in addition to furnishing information with regard to results of treatment, have also taught us a great deal regarding the potential vascular capacity of an extremity suffering from arterial obstruction and the role of vaso-spasm in this impairment. It also furnished us with a means of determining the prognosis and a method with which we can select our cases and fairly accurately determine those that can be helped or not.

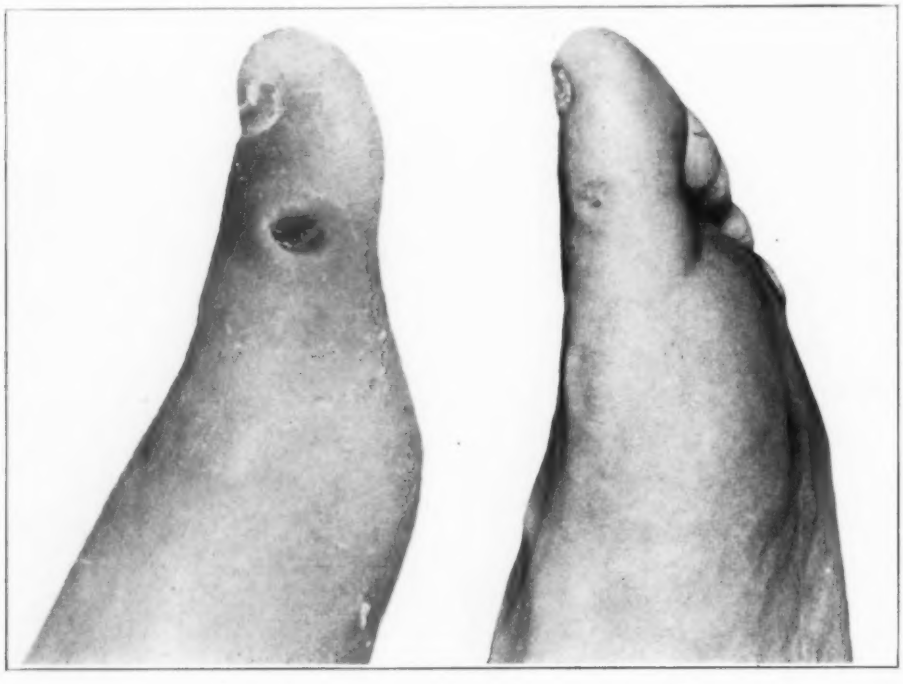
Figure 7 is a plethysmographic tracing performed upon a normal extremity. At the point marked by the arrow (V. P.), 70 mm. of pressure were applied to the proximal portion of the extremity. One observes that immediately following the interruption in the venous return, with the arterial pathway remaining patent, there occurs an increase in the volume of the



A B

Fig. 3. — Thromboangiitis obliterans of three years' duration. *A*, an ulcer of four months' duration is closed after three weeks of treatment, *B*.

extremity. During the first 10 seconds the rise is in a straight line following the course of a linear equation. At the end of 10 seconds the curve assumes a parabolic shape. This is because the entire capillary and venous bed is sufficiently large to take up the entire arterial flow during the first 10 seconds and after that there occurs a progressively increased resistance against the circulation by the accumulating blood. Thus, taking the first 5



A B

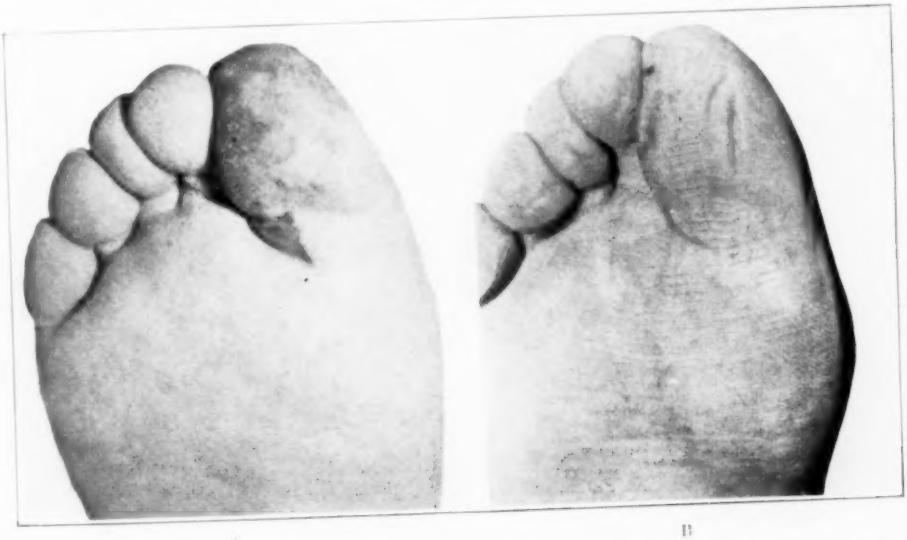
Fig. 4. — Case of thromboangiitis obliterans. Ulcer of three months' duration, *A*, with complete healing two weeks later, *B*.

TABLE 3. — *Summary of Cases of Peripheral Vascular Sclerosis (Non-Diabetic)*

		Per Cent
Total No. of Cases	33	
Males	28	....
Females	5	....
Incidence of open lesion	8	24
Pain Relief	27	82
Complete relief in 48 hrs.	4	12
Partial relief	2	6
No relief		
Ulcers or Gangrene	4	
Ulcers	4	100
Completely healed	4	
Gangrene	1	25
Completely healed	2	50
Healing	1	25
Failed		

A B

Fig. 5. — Diabetes with peripheral vascular sclerosis with marked obstruction to arterial flow and gangrene of three toes following a burn, *A*; completely healed, *B*, after six weeks treatment.



A B

Fig. 6. — Diabetes and peripheral sclerosis with sudden acute thrombosis of popliteal artery. Nine days after onset of the thrombosis there was marked rest pain, discoloration and anesthesia of great toe, *A*, but the pain was relieved nine hours after starting treatment, and three weeks later it was completely healed, *B*.

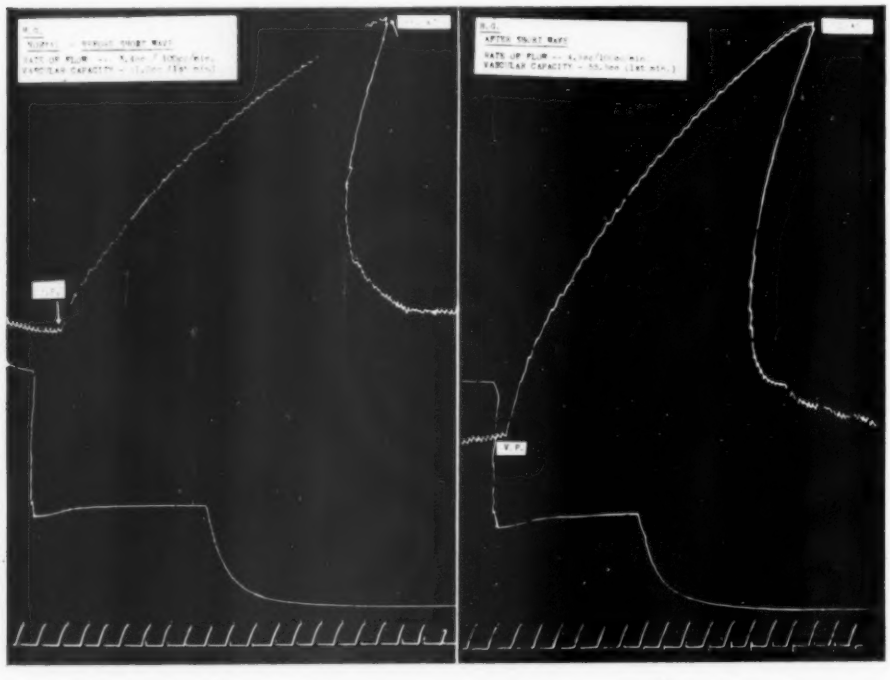
TABLE 4.—*Summary of Cases of Peripheral Vascular Sclerosis (Diabetic)*

		Per Cent
Total No. of Cases	63	
Males	30	...
Females	33	...
Incidence of open lesions	41	63
Pain Relief		
Complete relief of pain	37	59
Partial relief of pain	21	33
No relief of pain	5	8
Ulcer and Gangrene		
Total No. of Cases	41	
Healed	28	68
Healing	3	...
No healing } Failures {	5	...
Amputation } Failures {	10	25

TABLE 5.—*Summary of Cases of Embolus and Acute Thrombosis*

No. of Cases	7
Relief of pain—Complete in 8 hrs.	in all cases
Completely recovered	6
Amputation	1

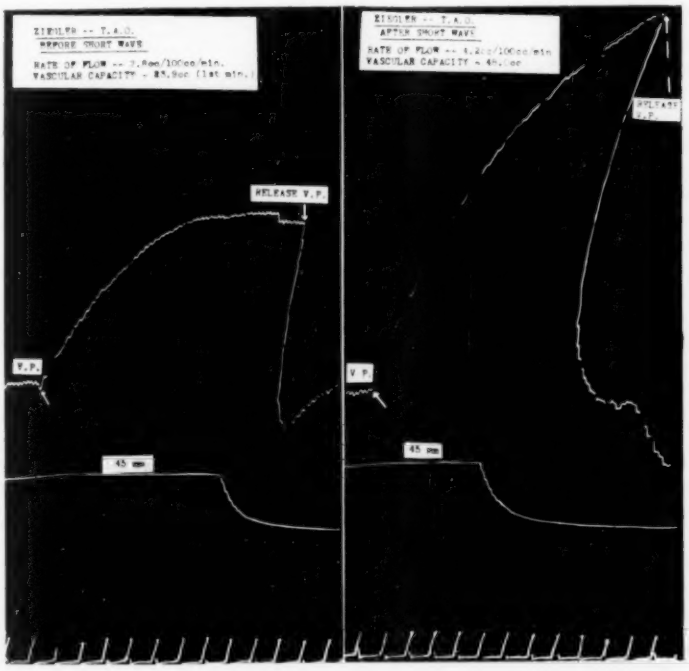
seconds following compression, in the absence of venous resistance, one has a ready method for establishing the rate of blood flow. The calculations indicate that in this extremity 3.4 cc. of blood flowed through 100 cc. of tissue per minute. The total rise in the extremity for the first minute following compression offers one a fair index of the total additional potential vas-



A B

Fig. 7. — Plethysmographic tracing taken on normal extremity. The tracing in *A* shows the increase in volume on the application of 70 mm. of congesting pressure to the thigh. The rate of flow is established from the rise in volume occurring in the first five seconds after the application of congesting pressure. The tracing in *B* indicates the marked increase in the rate of flow after relaxation of normal vasomotor tone by the application of short wave.

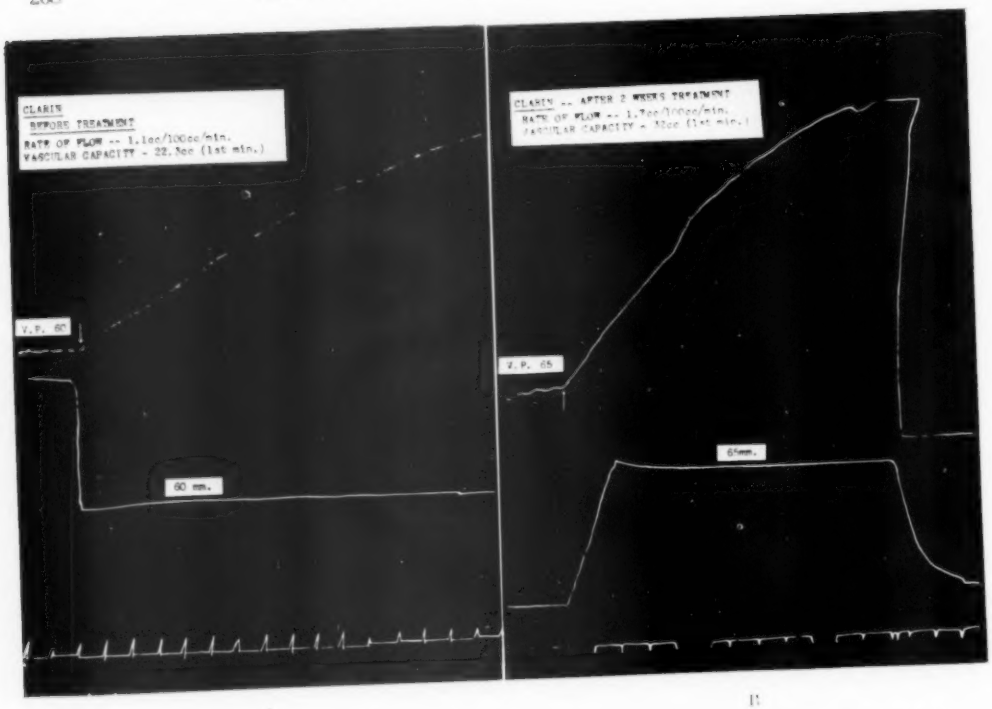
cular capacity of the limb. In this case it is found to be 41.0 cc. In figure 7b, the same reading is taken after the extremity has been subjected to an elevation of temperature to 100 degrees F. for 10 minutes by a short wave treatment. One can here observe a very startling change in the nature of flow and the potential vascular capacity. The rate of flow rises to 4.9 cc. per 100 cc. of tissue per minute, an actual increase of 44 per cent, while the capacity of the vascular bed rises from 41 to 51.5 cc., an actual increase of 35 per cent. This is obviously the result of the release of normal vasomotor tone with the creation of profound vaso-dilatation. This experiment has great clinical implications for it indicates that under stress arteries are so elastic that they have a capacity of transporting almost twice as much blood as they do normally. If there is such a large safety factor controlled by vasomotor tone, it becomes obvious that when organic obliterative disease develops, it is the vasospastic state which must be released in order to create any therapeutic effect.



A B

Fig. 8. — Plethysmographic tracing in a case of thromboangiitis obliterans. The control curve, *A*, indicates a reduction in vascular flow, while the curve in *B*, illustrates the marked increase in flow after application of short wave indicating large role of vasospasm.

Figure 8 illustrates the type of tracing which is obtained in a case of thromboangiitis obliterans with intermittent claudication. This patient is 40 years old and has had Buerger's disease for 6 years, his chief complaint being coldness of feet, some nocturnal rest pain and intermittent claudication on walking two city blocks. Oscillometric readings and surface temperature studies showed that he had evidence of a moderate degree of occlusion. The plethysmographic tracing discloses a reduction in the rate of flow to 2.8 cc. for 100 cc. of tissue per minute, with the potential vascular capacity being 23.9 cc. After 10 minutes of short wave treatment one notes a remarkable increase in the rate of flow to 4.2 cc. for 100 cc. of tissue per minute (which is practically normal) with the vascular capacity reaching



A B

Fig. 9. — Case of diabetic peripheral vascular sclerosis with gangrene of toe and heel. The marked reduction of flow is seen in *A*, while in *B*, is seen the moderate increase in vascularity after two weeks of treatment by intermittent venous occlusion.

48 cc. On the basis of this study it was apparent that there was a very powerful factor of vasospasm playing a part in this patient's condition. It was possible to predict that this patient would respond to treatment. After two weeks of treatment with intermittent venous occlusion his rate of flow and vascular capacity approached the normal. There was a simultaneous five-fold increase in his walking capacity and a complete disappearance of all subjective symptoms. His oscillometric readings were only slightly improved.

Figure 9 illustrates the nature of the plethysmographic tracing in a case of diabetic peripheral vascular sclerosis with a gangrenous ulcer on the heel and great toe of the right foot (fig. 10). This patient gave a history of intermittent claudication of two years standing and of the gangrenous

A B

Fig. 10. — The gangrenous ulcer on toe depicted in figure 9 as shown in *A*, and eight weeks after treatment, *B*.

lesions six months before coming under observation. He had suffered from an inordinate amount of pain and had been in bed in three different hospitals over a period of five months. He had received baking, wet dressings, intravenous hypertonic saline and tissue extract for a sufficiently long period to satisfy his physicians that these methods of treatment were of no avail. Oscillometric readings were absent in the foot and leg and showed only traces at the mid-thigh. There was a marked delay in venous filling time. After amputation at mid-thigh was suggested as the only logical procedure, he decided to try intermittent venous occlusion. One will observe the profound degree of vascular impairment from figure 9. His rate of flow was 1.1 cc. for 100 cc. of tissue per minute and the vascular capacity was 23.3 cc. After two weeks of intermittent venous compression at 40 mm. given continuously at one minute on and two minutes off, the vascular capacity rose to 32 cc., an improvement of almost 50 per cent in arterial flow. There was prompt relief of rest pain in this case within 48 hours, and at the end of four weeks the gangrenous slough began to separate with the appearance of healthy granulation tissue. Eight weeks after treatment the patient shows a healing granulation ulcer (fig. 10).

We have been able to demonstrate the development of dicrotism in the pulse during the phase of reactive hyperemia. This is a graphic indication to us that the release of venous compression is associated with a definite increase in the lumen of the arterial tree.

Discussion

This paper has been concerned with an attempt at elucidating the mechanism which lies at the basis of the clinical application of intermittent venous occlusion. We have found that the plethysmographic tracings have furnished us with an accurate method for determining the rate of blood flow through extremities and given us a concept of the potential vascular capacity which is normally held in check by the sympathetic fibers which control vasomotor tone. It appears that when impairment in circulation arises from the obliteration of the lumen of both the main arterial pathways and the collaterals, relaxation of vasomotor tone does not increase arterial flow. Under such circumstances one is dealing with a type of circulatory impairment that is beyond medical relief and might adequately be compared with a state of cardiac decompensation without cardiac reserve. When one meets with the type of case in which impairment arises from organic obliterative disease upon which is engrafted a vasospastic state, this is probably a form of decompensation with a sufficient reserve that can be influenced by creating vasodilatation.

We feel that after three years of clinical application, intermittent venous compression is one of the most effective methods for producing active vasodilatation. Lewis indicated that this vasodilatation which accounted for reactive hyperemia was the result of the elaboration by tissues subjected to venous congestion of an "H" substance which had profound vasodilating properties. Barsoum and Smirk[4] have recently confirmed this impression and have isolated a substance under these circumstances which shows the vasodilating effects. There is an interesting aspect to this subject which has been recently presented by Menkin.[5] In studies on the mechanism of inflammation he has succeeded in isolating a crystalline substance from the exudate which has remarkable effects in increasing the permeability of the endothelial wall, thus permitting greater capillary filtration. This substance he calls *leukotaxine*. In addition it is capable of permitting the passage of leukocytes and has the property of decreasing the tonus of an isolated loop of

Fig. 11. — Method of applying intermittent venous occlusion and short wave simultaneously. The elevation in the temperature of the deeper structures is outlined to accentuate the phenomenon of reactive hyperemia. For ambulatory cases short wave and intermittent venous occlusion are given simultaneously, then venous occlusion treatment is continued for another one-half hour.

a guinea pig's intestine. It is also a powerful vasodilator. Menkin believes that it is probably this substance, leukotaxine, which is elaborated by tissue cells in Lewis' reactive hyperemia. This concept seems to explain our own observations which we made in patients who had infected suppurating lesions and were subjected to intermittent venous compression. We have found that when the compression treatment is applied there occurs a remarkable increase in the amount of pus discharged from these wounds. Is it not possible then that Bier's hyperemia and intermittent venous compression result in the healing of infections and ulcers by virtue of the stimulation of leukotaxine production and thus accelerate this phase of the mechanism of inflammation?

De Takats[6] has recently published a paper in which he attempts to indicate that the method of treating these cases by intermittent venous compression can be enhanced by elevating the limb during the phase of release to allow the blood from the veins and capillaries to flow into the general circulation. He seems to feel that the emptying of the venocapillary bed creates a potential vascular space for facilitating the filling of arterial blood when the congesting pressure is applied. An examination of our plethysmographic curves will disclose that immediately upon release of pressure the volume of the extremity drops precipitously indicating that the venous blood has promptly entered the systemic circulation. Furthermore, the straight line rise for 10 seconds following compression would in itself prove that the venocapillary bed plays no part in creating a resistance sufficient to retard arterial flow. We are, therefore, unable to subscribe to this concept and feel that it creates an additional unnecessary complication to this simple method of treatment.

A few words about the value of short waves. It appears from our studies that the application of short waves has the property of producing a most profound degree of vasodilatation probably as a result of the eleva-

tion of the temperature of the deeper structures. This must undoubtedly be true also of diathermy. We have, however, observed that the introduction of deep heat is a double edged sword and when given to patients in excessive dosage will result in the production of vasospasm and induce pain. It is therefore recommended that the elevation in temperature be only minimal and be given to a point where the surface temperature does not rise higher than 100 F. It will be found that this is well within the limit of comfort to the patient and is always associated with active vasodilatation. We give our patients daily mild short wave applications simultaneously with intermittent venous compression (fig. 11) and have found that it is capable of greatly accentuating the phenomenon of reactive hyperemia. We are thus able to recommend elevations in the temperature of the deeper structures as an important adjunct in the treatment with intermittent venous compression.

Conclusion

The use of intermittent venous occlusion is presented for the treatment of peripheral vascular disease and the physiologic mechanism responsible for the therapeutic effect is elucidated.*

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* Note: We wish to express our deep appreciation to Dr. Milton Landowne and L. Meister for their early assistance in the construction and development of the plethysmograph. We also thank Dr. Henry Joachim, the chief of the Medical Service, for his kind cooperation.

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*(Discussions on this article will be published in an early issue.—*ED.*).*

EFFECT OF ARTERIO-VENOUS SHUNT IN PERIPHERAL VASCULAR DISEASE *

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The clinical symptoms of an insufficient blood supply to the extremities in arteriosclerosis or endarteritis obliterans are well known. However, we have very little information concerning the metabolic changes in the tissues with acutely arrested or chronically impaired circulation. Such information would lead into the paramount problem of local circulation: the performance of metabolic processes under varying external conditions. It would give us much more knowledge concerning the actual efficiency of the peripheral circulation than oscillometric, plethysmographic, skin temperature — and histamine tests. It does not deal with minor functions or symptomatic effects of the peripheral circulation, but with its very purpose, the metabolism of the tissues.

Studies of local tissue metabolism within the intact body meet with great technical difficulties. The only practical possibility in humans is the examination of metabolites in the blood carried to and from the tissue. Thereby, however, we obtain the result of two variable factors, tissue metabolism and circulation, and it will frequently be difficult to decide which of these is responsible for a given change.

Partly for the latter reason we did not compare in our experiments arterial and venous blood, but venous blood from the same part of the body with varying external conditions or venous blood from two comparable parts of the body under identical external conditions.

We examined the blood for the following constituents: O_2; total CO_2; CO_2 combining power of the plasma; lactic acid; blood sugar. In one part of the experiments total non-protein N, urea N, and non-protein-non-carbohydrate C was estimated. The importance of O_2 and CO_2 studies do not need much explanation. Rapid local circulation or low tissue metabolism produce high O_2 and low CO_2 values of the venous blood. A diminished local circulation or a high tissue metabolism result in low O_2 and high CO_2 values of the venous blood. O_2 and CO_2 studies have frequently been carried out to investigate the influence of heat or cold or therapeutic measures upon the local circulation. No efforts have, to my knowledge, been made to study the influence of peripheral vascular disease itself upon the O_2 and CO_2 contents of the blood of the diseased extremities and to correlate them with other blood constituents and with the results in normals.

The CO_2 combining power or alkali reserve of the plasma demonstrates the amount of its basic substances, neutralized by carbonic acid or other weaker acids and available for the neutralization of acid metabolites. It will become diminished when the production of such metabolites is increased — acidosis — and will be abnormally high with a low formation of acid metabolites or an increased liberation of basic substances, like sodium or potassium — alkalosis. Such changes may be local or systemic.

Lactic acid is one of the normal metabolites of the muscle during exercise

* Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 24, 1937.

and is partly transformed locally into glycogen, partly carried off by the circulation to be transformed into glycogen by the liver or eventually to be excreted by the kidneys. With physiologic exercise in a normal muscle and with normal circulation immediately recovery takes place and lactic acid does not appreciably increase in the muscle or its venous blood. With strenuous exercise the lactic acid of the venous blood will markedly increase and its removal from the blood may require considerable time, about one-half hour. The same amount of exercise may be strenuous for a scant, untrained muscle and physiologic for a well developed and trained muscle.

Glucose was examined because it is the most important source of energy for peripheral tissues. The N- fractions and the rest- carbon were investigated in search for intermediary metabolites.

The methods used were those of van Slyke and co-workers. All precautions for the analysis of O_2, CO_2 and lactic acid in blood were carefully observed and double analyses were performed in all cases. The peripheral circulations of those experimented upon were clinically thoroughly investigated.

Laboratory Demonstration on Blood Constituents

The results to be presented can be separated into two groups: experiments on normal individuals and on cases of peripheral vascular disease, the former being the basis for the evaluation of the latter. I first demonstrate the normal average values of the above blood constituents, as available in the literature.

TABLE 1.—*Results of Vascular Spasm and its Release in Normal Subject*

O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
Rest	Cold Reflex	Rest	Cold Reflex	Rest	Cold Reflex	Rest	Cold Reflex	Rest	Cold Reflex
20.2	16.2	54.6	56.4	53.5	52.5	8.4	14.9	90	76
Rest	Pain Reflex	Rest	Pain Reflex	Rest	Pain Reflex	Rest	Pain Reflex	Rest	Pain Reflex
15.1	8.8	56.2	61.1	.....	.....	.....	.....	150	142
Cold Reflex	Histamine	Cold Reflex	Histamine	Cold Reflex	Histamine	Cold Reflex	Histamine	Cold Reflex	Histamine
15.0	19.1	52.5	50.5	50.5	56.2	.....	.....	102	107

Table 1 of our own experimental data demonstrates the results of a vascular spasm and its release in a normal subject. At a room temperature of 71 F. and at rest, blood was drawn from a deep left antecubita vein, then the right forearm was immersed in ice water at 36 F. The skin temperature of the left forearm dropped within fourteen minutes from 89.6 to 86.2 F. Blood was again taken from the same left vein. The cold reflex from the right to the left arm resulted in a sharp decrease in O_2, an increase of CO_2 and lactic acid and a decrease of the alkali reserve and blood sugar. Similar changes in O_2 and CO_2 resulted when vascular spasm was produced by a painful stimulus. These results are in every detail compatible with a decrease in circulation, caused by vascular spasm, the metabolism remaining unchanged as the examined left arm was kept at rest and room temperature. The first experiment was repeated and blood first taken from the left forearm, when its skin temperature, after immersion of the right forearm into ice-water, dropped about 2 degrees. Histamine iontophoresis was then applied to the left forearm for 10 minutes, the right forearm still being kept under ice-water. The skin temperature of the left forearm rose again and the blood showed an increase in O_2, in alkali reserve and blood sugar and a decrease in CO_2. A primary vascular spasm produces marked chemical changes in the peripheral blood, the result of diminished, slow circulation. Histamine is capable of overcoming the vascular spasm of a cold reflex, and

apparently dilates, by reflex-action from the skin, deep vessels. The demonstrated complete restitution of normal blood chemistry by histamine iontophoresis cannot result merely from an increased skin circulation.

TABLE 2. — *Effect of Exercise on Blood Constituents of Trained and Untrained Subject*

	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Rest	Exercise	Rest	Exercise	Rest	Exercise	Rest	Exercise	Rest	Exercise
Trained	12.7	11.5	54.2	54.6	47.2	48.4	14.8	16.2	79	79
Untrained	20.4	7.5	45.2	57.0	.....	.....	11.9	18.2	102	107

Table 2 demonstrates how little an adequate amount of exercise — 20 forceful contractions of the hand — affects the blood constituents of a trained subject and how marked the changes are in an untrained normal person for whom the same amount of exercise was too strenuous.

Complete arrest of circulation in normal individuals was effected by inflating a rubber cuff around an arm to a pressure of 180-200 mm. Hg. To secure an influx of capillary blood into the veins it was necessary to release the pressure to 100 mm. Hg. in drawing the blood. Ischemia of 5 minutes duration at rest and room temperature resulted in a marked drop of O_2, a moderate increase or an unchanged CO_2 and irregular variations of alkali reserve, lactic acid and blood

TABLE 3. — *Effect of Rest and Ischemia on Constituents of Blood*

Patient	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Rest	Ischemia	Rest	Ischemia	Rest	Ischemia	Rest	Ischemia	Rest	Ischemia
ISF	16.3	13.5	48.3	50.4	53	57	11.5	12.8	105	107
NBF	14.0	7.7	52.0	54.7	56.7	57.0	18.1	14.3	87	89
E	18.5	6.1	49.5	49.0	53.3	54.0	14.3	18.1	87	82

sugar (table 3). If ischemia was combined with 20 contractions of the hand, the slump in O_2 was very marked and so was the increase in lactic acid (table 4).

TABLE 4. — *Effect of Ischemia and Exercise on Constituents of Blood*

Patient	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Rest	Work	Rest	Work	Rest	Work	Rest	Work	Rest	Work
H	18.2	12.1	51.2	51.1	55.0	55.0	19.0	39.8	88	96
B	10.1	5.1	55.2	54.4	59.0	59.0	12.4	80.4	81	87
S	14.7	6.1	50.9	51.0	51.1	53.3	13.9	40.9	85	89
T	14.8	12.1	53.6	53.4	56.7	55.0	22.7	37.5	102	90

However, there is practically no change in total CO_2 and alkali reserve. We assume a complete neutralization of lactic acid in the tissues before it pours into the circulation and the use of O_2 for intermediary oxidations without formation of free CO_2 when a muscle contracts while its circulation is arrested. Search for such intermediary metabolites has not been successful. If the circulation is com-

TABLE 5. — *Recovery Effect on Blood After Exercises on Ischemic Tissues*

Patient	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Work	Release	Work	Release	Work	Release	Work	Release	Work	Release
B	7.0	17.1	52.2	45.0	58.0	56.7	77.3	56.1	78	87
H	4.8	16.0	53.5	50.8	56.7	54.0	.....	108.5	82	82
S	6.8	13.7	50.3	50.8	60.1	54.5	44.9	52.6	94	85

pletely released following ischemic exercise (table 5), the O_2 rapidly climbs up to high-normal values (within 20 seconds) and total CO_2 is diminished. The alkali reserve drops, lactic acid, however, remains very high. There is appar-

ently a marked O_2 debt, but O_2 is carried through the peripheral circulation without being utilized. Lactic acid is now being neutralized partly at the expense of the alkali reserve, and there is an acidosis compensated by a loss of free CO_2.

In a last series of experiments on normal individuals venous blood from the

TABLE 6. — *Comparison of Venous Blood Changes of Forearm and Foot in Normals*

Patient	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Fore-Arm	Foot	Fore-Arm	Foot	Fore-Arm	Foot	Fore-Arm	Foot	Fore-Arm	Foot
J. By	17.7	16.9	47.5	46.	.....	.....	16.0	15.8	88	85
K. Ha	18.8	17.0	51.4	51.2	51.6	48.0	15.9	14.1	89	82
G. Ste	11.3	14.4	53.5	52.0	51.0	50.3	14.8	15.	84	89
A. La	16.7	17.4	46.9	43.0	.....	.....	10.1	12.	.....	.....

forearm and from the foot was compared (table 6). The individuals were kept at complete rest for 30 minutes, upper and lower extremities relaxed in dependent position, uncovered and exposed to room temperature. Then blood was taken. In two experiments the values of O_2, CO_2, lactic acid and glucose in the blood from forearm and foot were practically identical. In two other persons the blood of the foot carried slightly or definitely more O_2 and less CO_2 than the blood from the arm. Lactic acid and alkali reserve were identical. In all cases the skin temperature of the foot was lower than the one of the forearm, the feet appeared cyanotic. However, the examined blood constituents showed either identical values on forearm and foot, or the foot blood was more arterialized than the arm blood.

To summarize our results in normals: Producing a vascular spasm we found, as expected, signs of a slow circulation, a decrease in O_2, increase in CO_2 and slight increase in lactic acid, decrease in alkali reserve and blood sugar. Complete arrest of local circulation resulted in a marked loss of O_2, CO_2; alkali reserve, lactic acid and blood sugar varying, but not very significantly. Muscular exercise in a trained person produced but little alteration in the blood constituents, and in an untrained person was followed by a marked fall of O_2, increase in CO_2 and lactic acid. Muscular exercise under ischemic conditions caused in the blood drawn from the ischemic area a very marked drop of O_2 and a very sharp increase of lactic acid. However, total CO_2 and alkali reserve remained unchanged. Blood sugar was slightly increased. Comparison of venous blood from the forearm and the foot of the same person showed either identical values or somewhat more O_2 and less CO_2 in the blood of the foot.

Clinical Investigations

The second part of our investigations concerned patients with peripheral vascular disease. The grouping of the results will, for the sake of later discussion, be different from the above. All cases had advanced arteriosclerosis, eventually with diabetes or advanced endarteritis.

TABLE 7. — *Venous Blood of Forearm and Foot in Peripheral Vascular Disease*

Patient	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Fore-Arm	Foot	Fore-Arm	Foot	Fore-Arm	Foot	Fore-Arm	Foot	Fore-Arm	Foot
Si	15.2	18.7	52.1	49.9	.....	.....	14.2	17.7	92	92
La	18.0	20.2	52.8	52.	.....	44.5	10.0	15.1	89	76
Gli	9.8	18.1	53.8	48.3	49.3	45.5	12.5	13.9	197	231
Si 2	16.3	18.1	50.0	49.7	48.2	41.3	16.7	18.0	94	96
Bo	11.4	19.5	50.0	44.3	52.	48.3	15.6	17.2	116	122
Fe	10.5	12.6	51.8	50.4	.....	.....	14.1	14.5	.....	.....

Table 7 demonstrates the values of blood from the forearm and the foot of

6 cases of arteriosclerosis. The circulation of the legs was clinically markedly impaired in all of them and the blood supply of the upper extremities apparently sufficient. Again the patients were kept at rest and room temperature, legs and forearms exposed and in dependent, relaxed position for 30 minutes before blood was taken. During the experiments the skin temperature of the feet was in 5 patients between 11 and 7 and in case 5, 3 F. lower than the temperature of the forearms. The feet looked markedly cyanotic. In all 6 cases the venous blood from the foot — with its markedly impaired circulation — contained more O_2 than the venous blood from the forearm with a normal blood supply. The surplus of O_2 of the foot-blood varied between 1.8 and 8.1 volume per cent. It was especially high in case Gli with an indolent ulcer on the big toe, and in case Bo with a dry gangrene of the heel. Both patients are diabetics, and each lost one lower extremity several years ago by gangrene necessitating a mid-thigh amputation. Total CO_2 was almost identical in 2 cases, slightly or in two patients markedly lower in the foot blood than in the arm blood. The latter are the two individuals with a very high O_2 surplus. The alkali reserve was lower in the foot blood. Lactic acid was at rest on the upper normal limit or slightly increased in four cases, higher than normal in two cases, but not in a single instance lower in the foot blood than in the arm blood. Glucose varied irregularly.

For theoretical reasons and with our results in producing a vascular spasm in mind, we expected, as a sign of a locally impaired circulation, a local anemia and an increased amount of CO_2 in the venous blood coming from diseased extremities. However, we obtained from diseased extremities O_2 values which were in 5 out of 6 patients close to arterial ones. In all 6, the O_2 values from the legs with clinical signs of arterial obstruction were higher than those from the forearms with sufficient circulation. In our normal control cases the blood from the forearm and foot showed identical values, or the foot blood was slightly more arterial.

TABLE 8. — *Blood Changes Following Exercise in Peripheral Vascular Disease*

Patient	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Rest	Exercise	Rest	Exercise	Rest	Exercise	Rest	Exercise	Rest	Exercise
Ka	20.8	12.7	46.8	56.5	.....	.....	18.3	25.3	149	138
Ab. Gr.	11.6	8.2	51.6	55.8	51.0	55.2	20.0	26.7	259	261
Da. Gr.	15.6	8.7	50.8	56.6	47.0	50.0	29.8	35.3	134	127
La	13.5	14.8	56.4	58.8	51.5	55.0	32.2	37.4	190	201
Go	8.4	9.4	64.3	65.2	60.0	54.0	23.8	34.8	121	112

The situation becomes even more interesting in looking over table 8. Five cases of marked vascular obstruction were first kept at complete rest for at least 30 minutes, four of them having been chair-ridden for many months. A vein in the foot was then punctured. They then performed ten slow flexions and extensions of the toes. From the same vein blood was drawn immediately, the patients continuing to move the toes about ten times during the withdrawal of the blood. In three cases there was a marked drop of O_2, a steep increase of total CO_2, a definite increase of lactic acid and of the alkali reserve. The results are much the same as after exercise of an untrained individual. However, in two individuals exercise resulted in a slight but definite increase in O_2 combined with an increase in total CO_2 which is but moderate compared with the changes in the first three cases. Lactic acid was markedly increased. This is a striking combination: increased muscle metabolism with an O_2 debt, as seen from the lactic acid, resulting in higher O_2 values of the venous blood in areas with definitely impaired circulation.

In a last set of experiments we followed up the period of recovery after exercise. Blood was drawn from the same foot vein immediately after twenty

slow contractions of the toes and again after 30-60 minutes of rest. In normal individuals the slight changes occurring during physiologic exercises subside com-

TABLE 9. — *Changes in Blood Constituents After Exercise and Rest*

Patient ½ hour Rest	O_2		CO_2		Alkali Reserve		Lactic Acid		Glucose	
	Work	Rest	Work	Rest	Work	Rest	Work	Rest	Work	Rest
H (Normal)	16.6	15.9	50.0	50.5	51.9	56.1	18.1	12.8	87	78
Ro	13.3	16.3	58.6	49.4	60.0	50.0	24.0	15.0	81	85
D. Gr.	15.9	18.5	42.5	40.0	40.4	39.7	47.5	52.5	106	97
A. Gr. (arm)	11.2	10.1	51.2	50.6	48.0	49.0	31.7	22.0	177	170
La	13.3	20.1	63.8	51.9	58.8	58.2	19.7	14.6	88	94
1 hour Rest										
1 Gst	9.0	9.9	61.5	57.3	66.0	62.3	52.5	36.5	90	83
1 Go	21.2	21.4	45.1	45.5	49.7	53.3	17.3	15.1	.....	.....

pletely within 30 minutes. Table 9 demonstrates the values of 2 normals and 5 cases of peripheral vascular disease. Two of these cases behaved as expected of untrained individuals. A diminished O_2 returned to high or very high venous values, total CO_2 dropped markedly and the increased lactic acid returned to a high normal level after 30 minutes rest. Two cases retained low O_2 values for 30 and 60 minutes after exercise, showing only a moderate decrease in CO_2 and a very incomplete recovery from the local hyperlactacidemia. The last patient is most interesting, combining after 30 minutes rest, a definitely increased O_2 (3 vol. per cent) and a moderately falling total CO_2 not with a dropping, but a still climbing, very high lactic acid. Alkali reserve and glucose varied irregularly.

Comment

Discussing the above results in peripheral vascular disease, we start with the values, obtained from the diseased legs and normal forearms at rest. In our normal control cases the blood from the forearm and foot showed identical values — such are also reported in the literature — or the foot blood was slightly more arterial. In the cases of peripheral vascular disease the foot blood was always more arterial — in several cases very markedly so — and contained relatively high amounts of lactic acid. The higher O_2 values of the foot blood of normal subjects could be the result of a blood supply larger than the metabolic need of the tissue. However, the usually very exact regulation of blood supply and metabolic need, the cyanosis and lower skin temperature of the foot even in normals militate against the assumption of an active hyperemia, a blood supply from arteries through capillaries to the veins greater than the metabolic need of the tissues in normals. In our arteriosclerotic patients with marked symptoms of insufficient local blood supply a primary excess of circulation is quite impossible. Three explanations of our results seem possible: 1) a reduction of local metabolism in peripheral vascular disease, overcompensating the circulatory shortcomings, 2) diminished permeability of the capillary walls, similar to pneumoconiosis, 3) the blood, supplied through the larger arteries could be partly blocked in obstructed arterioles and precapillaries and shunted from the arterioles through arteriovenous anastomoses directly into venules, without ever reaching the capillaries and the tissues. The first two hypotheses can be discarded, because high O_2 values should then be combined with low lactic acid values and the capillaries should carry bright red blood — the skin should look bright red and not cyanotic as it really does. The only probable explanation is, therefore, a short circuit of arterial blood through arteriovenous anastomoses.

An arteriovenous shunt satisfactorily explains the striking results in the two of the exercise experiments: slight increase in O_2, moderate increase of CO_2 and

marked increase in lactic acid. Exercise produced in these cases an increased blood flow which, however, does not sufficiently enter capillaries and tissues. Therefore, the O_2 of the venous blood increases. The increased metabolism of the tissue results in an increased formation of CO_2 and of lactic acid — the latter much more intensive than the first, because of the poor blood supply through the capillaries to the tissues. The accumulation of these metabolites in the tissues will sooner or later be sufficient to increase their level in the venous blood, even in the presence of an arteriovenous shunt. With a short circuit of arterial blood to the veins, one of our patients, during the recovery period after exercise, increased the O_2 value of the venous blood in spite of a still increasing, very high lactic acid. In those cases of peripheral vascular disease reacting like untrained, overexercised subjects, however, the circulation through the capillaries is able to secure a full utilization of the blood in the tissues. In such cases the blood supply to the tissues during the period of recovery may be sufficient for a return of the blood constituents to previous levels within one-half hour or it may be very unsatisfactory, O_2 remaining low and lactic acid elevated even after one hour. However, in this latter group of cases an arteriovenous shunt does not play a detrimental role during exercise and recovery.

The presence of arteriovenous anastomoses in the skin of hand and feet of humans has been known for many years. More recently they have been demonstrated in deeper structures, glands and the spleen. Havlicek assumes their universal presence in the human body. In normal individuals the skin anastomoses are used for the maintenance of the local temperature, opening under the influence of external heat or cold and thereby dissipating heat from the body without overburdening the capillary circulation. In peripheral vascular disease Popoff demonstrated histological alterations of the arteriovenous anastomoses which, though being different in arteriosclerosis, endarteritis and diabetes, all result in an open, uncontrolled, purposeless shunt of arterial blood into the veins. Popoff himself examined forearm and foot blood of one such patient concerning its O_2 values and obtained more O_2 in the foot blood.

The clinical significance of the above results is apparent. They demonstrate the presence and detrimental role of an arteriovenous shunt for the local circulation in peripheral vascular disease. In our cases, arteriovenous anastomoses have been regularly open at rest, perhaps in a not very successful attempt to maintain the local temperature. With exercise, in most of the experiments, the anastomoses close sufficiently and capillary circulation prevails. In several cases, however, shunting of arterial blood takes place during and after exercise. Probably cases with signs of an open shunt even during exercise when the capillary blood is badly needed, have a poorer prognosis than those acting like untrained individuals. Our therapeutic measures open arteriovenous anastomoses as well as or more than capillaries, and therefore our clinical results are frequently not very satisfactory even when we elevate the skin temperature. One of our therapeutic problems is to close the shunt and open capillary circulation. In cases of peripheral vascular disease in which shunt circulation does not prevail, exercise results in the simple chemical signs of an insufficient blood supply which may fail for shorter or longer periods after exercise.

If we recall for a moment the reported results, the great variety of adaptations of the normal peripheral circulation and the great difference between reactions of the normal and the diseased peripheral circulation are quite evident. The peripheral circulation is not just an anatomical structure, it is a functional entity varying from individual to individual and from moment to moment. Only close knowledge of these normal and pathologic functional changes will enable us to understand the problems of peripheral vascular disease and to treat it properly. I hope that our experimental work is one step of the many which have been done and have to be done for such an advancement of our knowledge.

245 E. 207 St.

HOME-MADE WHIRLPOOL BATH SUITABLE FOR ARMS AND LEGS *

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The average whirlpool bath in use today has one or more disadvantages: it is suitable only for arms or legs, and even when applicable to both, lacks sufficient swirling and air mixing to be of real value in the treatment of one or the other extremity. Many baths use mechanical agitators which impart sufficient swirling motion to the water but frequently do not provide sufficient air mixing; such baths do not provide a continuous water flow. This latter circumstance renders difficult the maintenance of the desired water temperature throughout the treatment, and may further necessitate disinfection of the bath following treatment of a case with a draining sinus. We have, therefore, endeavored to design an inexpensive whirlpool bath that would overcome these disadvantages.

The bath constructed by us has the following dimensions: Length 28½, width 12, depth 27½ inches. The tank is made of copper with two inlets connected through a "T" joint with a common pipe from a mixing valve. Each inlet is equipped with a one-half inch McDaniel suction tee, with an air-vent pipe from the tee to the top of the bath thus providing adequate air mixing; the inlets are placed 4 and 18 inches above the bottom and near

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Fig. 1. — Bath empty; showing both inlets with air-vents, overflow outlet and drain-pipe. Inset — cross-section view of McDaniel Suction Tee *A*, air vent; *B*, water inflow.

Fig. 2. — Bath in use; patient exercising knee.

the outlet. The piping used throughout is standard 1 inch galvanized pipe. The overflow outlet is placed at one end as near the top as is practicable (2½ inches from top of bath to top of overflow); the diameter of this is 2½ inches. The entire bath is placed on one thickness of a 2-inch plank to facilitate assembly and drainage.

The cost of a tank made of stainless steel would be greater than for one made of copper, but the appearance and wear resisting properties of the former might well warrant the added expense. Our unit has been finished on the outside only with one coat of aluminum paint followed by two coats of white.

In using the bath for treatments of the arm the patient sits in an ordinary chair, while for treatments of the leg the patient sits on a stool the seat of which is level with the top of the bath.

It has been our experience that this bath gives adequate space for the patient to carry out all desired underwater exercises for the arm and leg, including the knee. The two inlets provide ample swirling and air mixing for the entire depth of the bath. The 2½ inch outlet is sufficiently large to maintain the water at a safe and desirable level. In operation the water level is 2½ inches below the top of the bath.

Conclusions

1. Whirlpool baths in use today have one or more disadvantages.
2. An inexpensive whirlpool bath is described which overcomes these disadvantages; it may be constructed by any competent tinsmith or plumber.
3. This bath is suitable for treatment of arms and of legs including the knee.

333 North Randall Avenue.

Trench Mouth Threatens to Be Always With Us

Trench mouth, which plagued the doughboys in France, threatens to become one of the diseases that are always with us, or as scientists say, endemic in this country, Dr. Don Chalmers Lyons of Jackson, Mich., declared at the meeting of the Society of Bacteriologists, Pathologists and Allied Workers of Michigan, Ohio and Indiana.

Carriers, that is, persons who have trench mouth without knowing it, and improperly cleaned beverage glasses are the means by which this disease is spreading, Dr. Lyons stated. He quoted impressive figures to show the increase in cases of this disease within recent years.

"In the state of Washington, where it is classed as a common communicable disease and according to law reportable within 24 hours to county and city health officers, there were 7 cases reported in 1931 and 343 in 1934; a tremendous increase from a percentage standpoint," Dr. Lyons said, "Ninety-five cases were reported in Illinois in 1931 and 758 in 1934, or a 700 per cent increase. Eight hundred and eighty cases were reported in up-state New York in 1931 and 1,733 in 1934, or more than a hundred per cent increase. One can safely say that if all cases were reported the figures would be even more impressive."

Dr. Lyons and other scientists have examined glasses as they came back from customers in beverage dispensing establishments and also as they hung on the rack, supposedly clean and ready for use. They found many of the "germs" of trench mouth on the rims of both dirty and clean glasses. Reporting this investigation, Dr. Lyons said that one's chance of getting trench mouth with a glass of beer were one in five.

The chronic stage of the disease is the most important from the public health standpoint, Dr. Lyons said. The organisms or "germs" that cause it are apparently not normally found in the mouth but they may get into the gums and propagate there without causing much discomfort to the patient. The latter does not realize he has the disease, does not have it treated, and unsuspectingly passes on the organisms to susceptible persons, who may then suffer from the acute stage of the disease.

Dr. Lyons gave three measures for checking the spread of trench mouth. These are:

"1. More rigid enforcement of sanitary standards in beverage dispensing establishments.

"2. Better control of Vincent's infection (the scientific name for trench mouth).

"3. Education of the public to demand proper sanitary measures to protect their health." — *Science News Letter.*

THERMAL EFFECTS OF SHORT WAVE DIATHERMY ON BONE AND MUSCLE *

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and

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It has been generally assumed that heat is generated in osseous tissues when a high frequency current is passed through the body. This assumption has not been proved. Schliephake[1] has claimed that by selection of the proper wave length given off by a short wave diathermy apparatus, any tissue can be selectively heated to a maximum degree. The truth of this claim has been established for dead tissues, but its validity for living tissues has not been substantiated.

The following investigation was undertaken to answer two specific questions. First, can heat be produced in bone marrow in living animals by subjecting the leg to short wave diathermy? Second, if the bone marrow is heated, is its temperature higher than that of the adjacent muscle?

Methods

Experiments were performed on the femur of large dogs weighing 50 to 70 pounds. Temperature was measured by thermocouples made of constantan and copper wires (28 gauge Leeds and Northrup double cotton covered and enameled) soldered into the tip of a 16 gauge lumbar puncture needle. The thermocouples were connected to a potentiometer (Leeds and Northrup portable precision type No. 8662) through parallel double pole switches. The couples were calibrated against a Bureau of Standards thermometer with scale divisions of 0.1 F. The thermocouple and potentiometer combination showed an accuracy of ± 0.2 F.

In the first series of experiments a thermocouple was aseptically buried in the bone marrow of the upper third of the femur, the insulated leads being inserted beneath the skin and passing downward to the skin of the paw. After several weeks when healing was complete, the leads near the paw were exposed under barbital anesthesia, and another thermocouple was inserted into the muscle of the thigh through a hard rubber cannula. Following the initial temperature reading, the thermocouple in the muscle was removed and then short wave diathermy was applied. It was found that the muscle was heated to a greater extent than the bone marrow. Microscopic sections of the bone marrow at the point of location of the thermocouple revealed considerable inflammatory reaction. For this reason it was concluded that nothing was to be gained by allowing the thermocouple to heal in place. Accordingly strictly "acute experiments" were then resorted to.

In the subsequent experiments the mesial surface of the femur was exposed, drilled in the region of its upper third, and a hard rubber cannula was inserted into the drillhole. Through this cannula the hypodermic thermocouple was inserted into the marrow. By a similar technic described by us[2, 3] for the human thigh, temperature measurements were made in the muscles adjacent to the thermocouple in the bone, at a depth of 1.5 inches beneath the skin. The thermocouples in the bone and muscle were in the same antero-posterior plane, so that they would be located the same distance from the source of the heat, which was

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applied to the lateral surface of the thigh. The location of the thermocouples was verified at autopsy. The cannulae referred to made it possible to remove the thermocouple except when readings were made, so as to avoid any error due to their presence in a high frequency field. To avoid errors that might arise from the presence of the mesially placed cannulae and the operative wound, the electrodes were applied to the lateral aspect of the dog's thigh.

Each diathermy treatment was given for twenty minutes. Wavelengths of six, twelve and twenty-four meters were used. Two methods were employed to apply the high frequency current. Air spaced electrodes (3 inch circular discs) were placed in the same plane and about 0.75 inches away from the lateral aspect of the skin of the thigh. With the electromagnetic field a "pancake" coil was used as an electrode with sufficient felt placed between the coil and skin to secure the maximum output without burning the skin. The tissues were examined grossly and histologically after the conclusion of each experiment.

Results

The essential results of eighteen experiments are recorded in table 1. Only the terminal temperature of the bone and muscle is given because the rate of

TABLE 1. — *Complete Experimental Data*

Experiment No.	Final Bone Marrow Temp. F.	Final Muscle Temp. F.	Remarks Apparatus	Electrodes	Separation	Spacing
1	107.4	108.6	6 meters	3″ air gap electrodes, 7 ″ center to center.	1½″ air space.	
2	103.7	104.7	6 meters	3″ air gap electrodes, 9 ″ center to center.	¼″ air space.	
3	106.7	108.9	6 meters	3″ air gap electrodes, 9 ″ center to center.	¼″ air space.	
*4	106.4	108.9	6 meters	3″ air gap electrodes, 7½″ center to center.	¼″ air space.	
*5	101.2	101.8	6 meters	3″ air gap electrodes, 6½″ center to center.	1 ″ air space.	
6	101.6	103.7	6 meters	3″ air gap electrodes, 7 ″ center to center.	1 ″ air space.	
7	104.6	105.8	6 meters	3″ air gap electrodes, 7 ″ center to center.	1½″ air space.	
8	106.3	107.2	6 meters	3″ air gap electrodes, 6½″ center to center.	1 ″ air space.	
9	106.2	106.7	12 meters coil flat pancake of 3 turns.	¼″ towel between skin and electrode.		
10	109.4	109.9	Same as above.			
11	107.2	110.2	Same as No. 9.			
12	109.4	111.3	Same as No. 9.			
13	103.9	104.4	4½″ circular disc electrodes.	Applied to ext. surface same plane; 7″ center to center.	1″ sponge rubber between skin and electrode surface.	
14	104.6	105.6	As above except air used as dielectric instead of rubber between skin and electrode surface.			
15	106.5	108.4	24 meters	Pancake coil technic.		
16	106.6	112.6	24 meters	Pancake coil technic.		
17	109.0	110.6	24 meters	Pancake coil technic.		
*18	107.8	114.3	24 meters	Pancake coil technic.	Superficial tissues coagulated and extending into muscles.	

* No. 4, * No. 18, coagulation of superficial tissues. Subcutaneous temp. — 114.8 F. in experiment No. 4.
* No. 5, initial bone temp. — 98.6 F. Initial muscle temp. — 98.6 F.
Cannulae were placed in upper ⅓ of the femur, and 1.5 inches deep into the muscle of the thigh.

heating showed no significant differences. The initial temperatures are not given because with few exceptions they averaged 101.2 F. The terminal temperatures vary because of uncontrollable factors. It is well known that in different anesthetized dogs different dosages of diathermy are required to produce similar rises in body temperature, and in these experiments it was deemed more desirable to endeavor to apply, as a rule, the same dose to each animal in a particular series of wavelengths. The rectal temperature was elevated to a variable extent but never to that of the locally heated tissues.

It is to be noted (table 1) that the temperature of the interior of the bone was increased. The temperature of the bone did not exceed nor attain that of the muscles. In experiments 4 and 18 in which the "physiologic dose" was exceeded, the skin and superficial tissues were coagulated and deleteriously affected histologically to a greater extent than the deeper tissues. In other words, a thermal gradient regardless of wavelength from skin to bone is evident, a result that should be anticipated unless tissue heating were specifically related to wavelength.

In table 2 are shown the average terminal temperatures of the bone and muscle for the three different wavelengths. It is to be noted that regardless of

TABLE 2.—*Final Average Temperatures*

	Bone	Muscle	Method Used
6 meters	104.7	106.2	Electric Field
12 meters	106.0	108.0	Electromagnetic Induction
24 meters	107.4	111.4	Electromagnetic Induction

the wavelengths the temperature of the muscle was always higher than that of the bone marrow. If a significant difference between the degree of heating of the two tissues with 6, 12, and 24 meter wavelengths exists, the results indicate that muscle heats to a great extent than the bone marrow. Such a difference is more evident with the 12 and 24 meter wavelengths. The increment for bone for the 12 and 24 meter wavelength is 1.4 F. and for muscle 3.4 F.

Discussion

The first question proposed for investigation is unequivocally answered. The internal temperature of the bone of a limb can be raised by applying short wave diathermy locally, to an extent greater than the rectal or general body temperature. The second question has been similarly answered; namely, on the application of short wave diathermy to a limb the temperature of the muscular tissue is elevated to a greater degree than that of the bone marrow.

When a limb is exposed to short wave diathermy the results indicate that the temperature of its tissues decreases from the skin, which is nearest the source of energy, toward the marrow of the bone. This thermal gradient from the surface to the interior of the limb is convincingly demonstrated by the fact that when the dosage was excessive, the histologic damage of the tissues manifested a similar gradient of injury from the skin to the bone. This confirms our previous observations on human subjects, in which the temperature at different depths in the tissues from the skin to the periosteum was determined after exposures of the thigh to short wave diathermy. That the bone does not heat more than the surrounding muscle, is fortunate, for otherwise short wave diathermy would be dangerous and, in view of its rather extensive use, would have produced necrosis of the bone in a large number of patients. As it is, the rich supply of sensory nerves to the superficial tissues serves to protect underlying tissues from injury. The difference between the degree of heating of dead and living tissues, which according to our results obviously exists, must be due to the fact that the circulating blood dissipates heat and plays a very significant role in the regulation of the temperature of the tissues. The importance of the circulation in this regard has been definitely proved particularly by the experiments of Mortimer[4] and the observations of Binger and Christie.[5] Mortimer determined the temperature of the same organs of animals on exposure of the trunk to short wave diathermy before and after death. He found that the temperature of the various organs varied little in the living but pronouncedly in the dead animal.

Claims that the wavelength specifically determines the depth and degree of heating and that wavelengths of approximately six meters heat bone or other deep tissues with less production of surface heat than do longer waves are not substantiated by our results. It should be recalled that such claims are not based on actual measurements of the temperature of living tissues. Our results on living tissues suggest the reverse of these claims; that is, they indicate that a wavelength of twenty-four meters is preferable to one of six meters for local deep heating. Such a conclusion is not warranted, however, because other fac-

tors than wavelength must be considered. Indeed, there is no way of determining quantitatively the output of energy delivered to the tissues by a shortwave generator. For example, one generator is built to deliver undamped waves of 12 meters and another of 24 meters. How much energy the two generators are actually delivering to the exposed limb at present cannot be determined. In view of our ignorance, it is more rational to postulate that when the twenty-four meter wavelength generator is used, more energy is delivered to the limb than when the other generator is used. Certainly it is erroneous that the observed difference in heating is related solely to wavelength. Hence, we believe that all claims regarding specificity of wavelength action are at present entirely hypothetical.

Conclusions

1. The local application of short wave diathermy to the thigh increases the temperature of the bone marrow, and, of course, the temperature of the bone marrow is increased more than that of the rectum or general body.

2. During the application of short wave diathermy to the limb of a living animal, the thermal gradient is from the periphery to the interior. The temperature of the muscle is higher than that of the bone marrow. Similarly, if injury accidently occurs, the degree of injury decreases from the periphery to the interior.

3. We could obtain no true evidence indicating that living tissues manifest a specific thermal response to short waves of different lengths.

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Spinach Not So Healthful as Has Been Supposed

Good news for spinach-haters! The leafy vegetable, obnoxious to many and unwillingly eaten because of widely heralded health value, is losing its high standing, discussions at the opening session of the American Institute of Nutrition revealed.

Spinach has been considered a valuable food because it has a high content of blood-and-bone-building iron and calcium. Less than half of the iron content of spinach, however, and less than a third of its calcium are in a form that can be used by the body, it appears from a report by Drs. M. K. Horwitt and G. R. Cowgill of research made by them at Yale University with the late Prof. L. B. Mendel.

Similarly, the amount of protein available for human nutrition is not what would be thought from the amount found in spinach by analysis.

In their research, the Yale investigators devised a method which in the future can be used for determining in other foods besides spinach the amount of nourishing substances actually available to the body, as compared with the amount theoretically available as judged by the total content of these substances found in foods by analysis. — *Science News Letter.*

ELECTROLYTIC ACTION BETWEEN METALS IN BONE SURGERY *

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Metallic fixation of fractures has been practiced for a long time but only with a variable success. Too many failures have been the incentive for the vast amount of research to find some reliable material. Metal being a foreign body, search has been made for some base metal or combination of metals, in mixtures or plating, or alloy that would consistently create the least disturbance in tissue and bone. These disturbances or reactions have caused an excess of fluid about the site of introduction, of tannish, brown or grey-black discoloration, with soft tissue destruction and absorption or necrosis of the bone. Too often the screws or metal pegs used have been found sufficiently loose to be easily removed with the fingers. This is true of a large per cent of nails, larger screws and wires used in hip fractures, as well as in the plates of the long bones. As a result there have been many cases of non-union or delayed union attributable to corrosion or the reaction of the tissue to the metal acting as a foreign body.

While there have been many successes so far as union of fractures is concerned, it has been the common practice to eventually remove the metallic appliances. On the other hand many patients have continued to carry a plate or peg for years without discomfort, which probably accounts for the belief expressed by Putti that it makes no difference what type of metal is used. In looking back, it may now be readily understood why all metals have shown so much disturbance. Our reply is that in such instances the battery has run down as the electrolyte has become inert; or, that changes in body chemistry play an important role.

All this has been generally spoken of as the corrosion of the metal and search made in bone surgery as well as in dentistry for a metal that would not corrode in the presence of the body salts. Many appliances, particularly of chromium plated steel, compounds of metals, vanadium steel and so-called rustless steel with varying formulae have been used with the same varying successes and failures. Certainly these have been better in that the percentage of successes is greater than when galvanized iron, bronze wire, ordinary steel nails and screws of low temper and nickel plated appliances were in general use. The reason is that the more recent appliances are more highly tempered or more perfectly alloyed, and so more resistant to the electrolytic action of body salts. The one exception is chromium plate steel which is particularly noxious and of which I shall speak later.

After an exhaustive review of experimental research and clinical data we concluded that the premise of the search was in error, because the results of the experiments as well as their deductions were at wide variance, each with the other, and yet no material had been found that was dependable. For that reason there still seemed to be an unknown factor that governed or controlled these variable effects which, if found, would open the way to further search in a more charted sea for some reliable substance.

Instead of assuming that a given metal was the offender and as such created the disturbance in tissue and bone, we labored on the principle that this unknown factor might be due to the body fluids acting as an electrolyte.

* Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 23, 1937.

To find and demonstrate the presence of electrolysis as a determining factor therefore became our problem.

Biochemical Action of Metals

A protocol was set up and a systematic attempt made to create batteries between different metals in bone in vivo. In doing so the law of the electromotive force of metals had to be followed to the letter, and the findings, as could only be determined through biochemical study, must consistently be in accord with this law, which is that of the attractive force of one metal upon the other. The further these metals are apart in this table of E. M. F. the greater the potential between them. For example, gold and aluminum are at the two extremes, so the most pronounced electrolytic action will be between them in which ions of gold will be given off and deposited upon the aluminum. Copper must go onto chromium — not chromium onto copper, zinc onto iron, and the like.

And so, in our study, unless the biochemical findings were consistent with this law the results of metallic or tissue changes could not be attributed to electrolytic action; but when these findings were consistent with this law, they could *only* be attributed to electrolytic action. To accomplish this a simple cell was made, like the cell of an automobile battery, using metals of different and wide potentials and depending upon the body fluids to act as the electrolyte in place of the acid in the ordinary battery.

As has been shown through a brief report of this study before the Texas Surgical Society in October and a more detailed review before the Southern Surgical in December we found in many experiments the transposition of ions of one metal upon the other in strict compliance with this law and in entire consistency with macroscopic, x-ray and histologic findings. In other words, we created batteries of the simple cell type in vivo in which electrolytic action between metals is definitely shown. Subsequently, using the same metals made into appliances for use in fractures, we have made galvanic batteries in physiologic salt solution in which corrosion of some and non-corrosion of one metal is plainly demonstrated. We have also created batteries of the simple cell type in physiologic salt solution which when coupled with a micro-ammeter shows the current and may be read on the dial. This instrument registers one two hundred millionth of an ampere.

Following these experiments we have been able to create a voltaic cell in vivo and record the current upon a micro-ammeter in variance with the potentials of the metals used in strict accord with the law of their electromotive force. The result of this definite exhibition of the presence of electrical current as established between metals in the tissues which is in strict corroboration with all of our other experiments, we believe to be the final incontrovertible proof that electrical phenomena are the cause of metallic disintegration and tissue and bone changes of metals in bone repair. We believe that this is the first occasion in which such a demonstration has been shown and proved.

All of the previous experiments of which we have spoken have been done without couples, i. e., without contact between them and so the action has been purely electrolytic.

The action about a single appliance, screw, peg or band of a compound or plated metal or alloy incompletely welded so that all of its components have not changed completely their characteristics and position in the table of E. M. F. of metals, is also electrolytic due to an effort to become demagnetized, called hystresis.

Using silver as a constant potential and other metals of varying po-

tential further up the table of E. M. F. and so creating a galvanic battery, in the subsequent experiments the intent was to show the presence of electric current in physiologic salt solution and in vivo. These have been done in couples — that is, with a connection between the poles or ordinary voltaic cell. This is the kind of current existing when couples are made with plates and screws in fracture fixation, and is of greater electrical force than simple electrolytic action without couples.

As we have pointed out, our study was to find a governing factor which we believe we have conclusively shown to be due to the electrolytic action between the metals which are affected by the body fluids acting as the electrolyte. Whenever a single component part is consistently given off into solution in the electrolyte, the action is electrolytic. This action we were able to demonstrate in many of our experiments finding iron from galvanized iron, vanadium steel and plain steel in adjacent tissues and in the liver; copper similarly from brass screws and silver plated copper screws; zinc from galvanized iron screws and chromium in large amounts in the tissues and liver from all chromium plated screws.

In many experiments, ions of one metal were found about and plated on the other metal, which in each instance was in accord with the law of the E. M. F. of metals. Between brass and steel screws copper was in tissues adjacent to steel; between copper and galvanized iron, copper was deposited on the zinc of the galvanized iron; between steel and silver plated copper, copper was deposited on the steel; and most interesting as between brass and chromium plated steel, the copper was on the chromium and chromium was on the zinc of the brass screw.

With this factor recognized, the problem was to find a metal or create an alloy, which will clinically meet the requirements of osteo-synthesis with metals in strength and manufacture, and must be one upon which the electrolytic action of body fluids is inert.

Silver, as we know, is well tolerated, but lacks the strength, as the pure metal, to be made into screws, nails and plates. When compounded with or plated upon other metals, an effect of its potentials creating a battery is produced.

Dentists have used gold many years satisfactorily as fillings, while amalgam fillings are considered temporary and are followed by electrolytic necrosis. We believe many cancers of the mouth are due to such continued electrolytic action. The steels as such have rusted or corroded easily and so have been compounded, plated and made into various alloys or compounds under the general heading of rustless steel, yet about each that we have used there has been marked tissue reaction and necrosis of bone, while biochemically there has been a large amount of iron free in the tissue and an excess in the liver.

We found the plated steels, particularly those treated with chromium, extremely noxious. In every instance there was a large amount of chromium in the tissue and liver of each dog in which the metal was used. These dogs invariably lost weight and in three instances died before time of sacrifice of chromium poisoning. The slightest crack in the plating or the screw sites in plates immediately creates a battery.

As we progressed in our experiments, we were supplied with an alloy made of cobalt, chromium and molybdenum, called vitallium, which contains no iron and is non-magnetic. We had never heard of it until it was suggested by Taylor Wheat, D.D.S., who had made for us a dozen screws. To our amazement and we may add pleasure, there was no tissue reaction and no necrosis about the vitallium screw in any instance, no matter what compound or mixed metal was used in conjunction. Each time it required

the same effort to remove the screw that it did to insert it, and there was no change about the metal.

As previously stated our effort was to determine whether electrolysis was the unrecognized factor which governed the application of metals in bone repair. This we have shown to be the controlling factor without which our observations concerning this alloy would be only another opinion of comparison. Since we are able to understand why it is not acted upon and check with other metals in an artificial cell of salt solution, both with and without contact with a micro-ammeter, and find it to be entirely non-electrolytic, it ceases to be a matter of opinion, but rather one of fact.

We feel that this observation is but a beginning, and that other metals may be developed to meet all the mechanical and clinical requirements in compliance with the principle of tissue and bone tolerance which seems to be the determining factor. Vitallium is too hard to be made into other than rigid appliances and pure silver, though ductile, hasn't the tensile strength. When plated or in conjunction with other metals it has a high electrolytic potential, being far down in the E. M. F. table.

With this factor known, further research and time may develop that which may be needed, but the principle is established and will remain.

Note: I wish to express my full appreciation for the unstinted help and cooperation of my associates, Doctors Walter Stuck and Asa Beach, in the study and all the experiments in this work. Without their suggestions and untiring collaboration, it would have been impossible.

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New Relativity Theory Explained by Author

The "New Relativity," described in the *Physical Review*, broadens rather than controverts Einstein's theory. It was suggested by the point of view presented by E. A. Milne of Oxford in his recent book "Relativity, Gravitation and World-Structure" in which the author dispenses with the undefinable concepts of rigid measuring rods and periodic clocks and bases his theory on the concept of light-signals traveling with constant velocity. In its present state of development the new theory is an extension of the special theory promulgated by Einstein in 1905, rather than a modification of his general theory of 1915. Hence its applications are to microscopic rather than to cosmic phenomena.

The inertial systems of Einstein's special theory constitute a group of reference frames each of which has a Euclidean geometry and a constant light-velocity. These reference frames have constant velocities relative to one another. The significant discovery reported in the "New Relativity" is the existence of other reference frames characterized by Euclidean geometries and constant light-velocities, which are accelerated relative to one another. If, then, there are no preferred reference systems in an effectively empty region, the laws of nature must be the same relativity to the newly discovered reference frames as they are relative to the inertial systems considered in Einstein's theory. In this way the theory leads to the possibility of types of motion not allowed by the older theories, and offers the hope of acquiring a better understanding of the motions occurring in the atom. — *Science News Letter.*

HYPERPYREXIA OF LYMPHOPATHIA VENEREA *

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and

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Lymphopathia venerea has been established as a clinical entity within the past few years[1], and was previously described under such names as: esthiomène, indolent inguinal adenitis, climatic bubo, anorectal syphiloma, and chronic genital ulcers. The disease is caused by a virus, is endemic in the tropics and often encountered in moderate zones.

Treatment in the past has ranged from radical surgery[2], chemotherapy, and certain types of vaccinotherapy[3, 4] to treatment by physical agents, such as x-rays, ultraviolet, diathermy and radium. Neither has proved absolutely satisfactory in all instances.

The authors, recognizing the resistant and disabling nature of lymphopathia venerea have subjected it to treatment by artificial fever for which use was made of the radiant heat cabinet, in which the patient's temperature is raised by the heating of circulating air which is blown over the body. At the Cincinnati General Hospital are two of the Kettering type of radiant heat cabinets operated by trained technicians who are expected to handle the patient mentally as well as physically. Especially important is the first treatment when the patient is very apt to approach the ordeal of fever therapy in a disturbed state of mind. Reactions are more frequent when the patient is mentally upset.

Nine patients with lymphopathia venerea were treated by fever therapy given under the personal supervision of Dr. Fred Goldman. Patients in the early stage were selected because any immediate benefit of such therapy on the inguinal adenitis could easily be determined. Furthermore, since lymphopathia venerea has been adequately proved to be a systemic disease[5], we could prevent its late manifestations, if such treatment were actually curative.

The patients were routinely given large amounts of 0.5 per cent sodium chloride solution and 20 grains calcium lactate the evening preceding fever therapy. On the morning of treatment breakfast was omitted. An enema was given at 6 a. m. In some cases a half grain of phenobarbital was given at 7 a. m. along with 100 cc. 5 per cent glucose and 100 cc. orange juice. Ten cc. of 10 per cent calcium gluconate was administered intramuscularly. At 8 a. m. the patient was taken to the Fever Therapy Department.

No unusual nursing precautions were taken as in cases of early syphilis, gonorrheal ophthalmitis, or meningitis. Blood pressure readings were taken before and at intervals during the treatments. Temperature and pulse were noted every five to fifteen mintues. Saline solution was taken freely by mouth. With one exception all patients were kept in the hospital between treatments; the exception received two treatments while in the house and two as an out-patient.

Analysis of Cases

During the past year and a half a group of nine Frei positive cases of lymphopathia venerea have been treated with fever therapy at this hospital.

* From the Cincinnati General Hospital, Department of Dermatology, Dr. Elmore B. Tauber, Chief-of-Staff; and the Department of Fever Therapy Research, Dr. Julian Benjamin, Director.

* Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 21, 1937.

CHART I

Cases		Genital Lesion	Onset Adenitis	Systemic Signs	Kahn	Remarks	Result
1	LK	0	2	+++	++	....	Im.
2	Coja	0	2	+	0	....	Im.
3	Caje	0	2	++	0	....	Im.
4	LS	Papule f	3	+++	0	....	Im.
5	CS	0	5	+	0	Received Tamura's antigen also	Im.
6	SC	Ulcer	1½	+++	0	.....	Im.
7	AC	0	1	++	+++	Relapsed	Sl. Im.
8	EB	0	3	+++	0	.....	Mod. Im.
9	MG	Vulvar ulcers	....	+	++	Induration unaffected	Sl. Im.

f = scabies.

The age distribution was between 19 and 32 years. Two women were included in the series, one white and one Negro. Although we see many more cases in the negro, it happens that in this group three of the males were white and four were negro. The chief complaint of all of the men and one of the women was an inguinal adenitis of from one to five weeks duration (chart 1). Regional adenopathy is the most consistent finding in acute cases. It may persist three to six months or longer if not treated. All but two of our patients stated that while the adenopathy had begun as a painless swelling, it had become more and more painful with increase in the size of the glands. Half of the cases presented a unilateral and half a bilateral adenopathy. The overlying skin tended to become red and adherent to the glands after which a violaceous discoloration appeared. In no case was there spontaneous sinus formation, but in three instances drainage occurred after aspiration of the glands had been attempted. The chief complaint of one patient without an inguinal adenitis was edema of the vulva of eight months duration with ulceration of the right labia majora for seven months.

Only two patients were able to recall a recent penile lesion and in both instances these had appeared after the onset of the adenitis. One gave a history of a small painless papule developing two weeks after a painful left adenopathy. This patient developed a typical scabies the first week in the hospital. The other, when admitted, had, on the glans, a small superficial painless ulcer with non-indurated edge. This ulcer healed after one fever treatment. The left inguinal gland in this case was aspirated and many tiny pockets of pus were found (typical of lymphopathia venerea).

Constitutional signs varied considerably in these patients, but all showed some. The least affected of the group had no complaint other than a painful left inguinal adenopathy and a five pound weight loss the week preceding hospitalization. Symptoms in their order of frequency were fever, malaise and weakness, headache, anorexia, weight loss, chills, night sweats, vertigo, constipation, and toxic eruption. The latter was seen in only one case and consisted of an erythematous maculopapular rash occurring principally on the arms and shoulders. Three cases presented mild constitutional manifestations; in two they were of moderate severity and in four were marked.

Three of the patients were found to have a positive Kahn test while one other gave a history of a chancre and some antisyphilitic treatment seven years previously; his Wassermann and Kahn reactions were negative.

Treatment

Fever treatment was usually instituted within the first week of hospitalization (chart 2). The notable exception in our series was the one female

CHART II

Case		Hosp. Days Before F.T.	Num. F.T.	Hrs. F.T.	Num. Days Consumed	Days After F.T.	Additional Therapy	Results
1	LK	9	3	9	8	2	Aspiration Neoarsph.	Im.
2	Co Ja	2	4	12½	17	2	None	Im.
3	Ca Je	7	5	10	22	8*	Aspiration	Im.
4	LS	9	4	18	12	2	Aspiration	Im.
5	CS	3	6	22	28	2	Aspiration Tamura's antigen	Im.
6	SC	2	2	3	5	1	Aspiration	Im.
7	AC	6	4†	20¼	30	....	Neoarsph.	Sl. Im.
8	EB	34	5	23⅓	26	2	Aspiration	Mod. Im.
9	MG	10	4	12	14	....	Neoarsph.	Sl. Im.

* — Reaction following 5th F.T.
† — 2 F.T. as outpatient and 2 F.T. as hospital patient.

who exhibited an inguinal adenitis. During her first week in the house she occasionally attained a temperature of 103 F. It was not until the fourth week that her temperature was at normal level. Aspiration of the glands was followed by prolonged drainage. Fever therapy was begun on her thirty-fifth hospital day. The number of treatments given to each patient varied between two and six, with an average of 4.1 treatments per patient. The total hours of fever at 105-107 F. endured by patients ranged from three to twenty-three and one-third hours. The average total hours of such fever per patient was 14.44.

The time consumed in a series of treatments averaged eighteen days. One individual received two treatments as an out-patient after having been in the hospital for two previous treatments. The remainder were hospitalized during the entire series of fever treatments. They usually left the hospital one or two days after the completion of fever therapy. One patient, in whom the only unfavorable reaction to fever therapy was noted, was discharged eight days after his fifth and last treatment. This patient was given five treatments for a total of 10 hours of 105 - 107 F. fever. Following the last treatment he developed abdominal distention and tenderness with nausea and vomiting and fever which fell by lysis only after 3 days. His white blood cell count was 12,000 with 86 per cent polymorphonuclear leukocytes. Consultants believed his condition constituted a fever therapy reaction. He recovered under conservative measures including glucose and saline solutions administered parenterally.

Those patients found to have positive Kahn tests were given neoarsphenamine. No other chemotherapy was given in this series. In six cases the involved glands were aspirated and this procedure was followed in three instances by drainage at the puncture site. One male, who had a bilateral adenitis of five weeks duration, was given eight subcutaneous injections of Tamura's cultured antigen[5] in doses ranging from 0.15 to 0.4 cc. over a period of seventeen days. His fever therapy was given during the same time.

Results

We defined improvement as a decrease in the size of the glands to the extent that the patient could return to work without any discomfort, and an absence of suppuration and systemic symptoms. We do not use the word "cured" for we are unable to say whether or not these patients will finally exhibit late sequelae of lymphopathia venerea infection. Such a group of patients is difficult to follow for they do not tend to cooperate. We have no record of three of these patients after their discharge from the hospital.

Of the seven men treated six were improved upon discharge from the

hospital. One patient who had had bilateral adenopathy underwent operation for an indirect inguinal herma six weeks after fever therapy was discontinued. When seen 12 months after discharge the inguinal glands were normal. Another of the improved patients has normal glands and was without sequelae, eleven months following discharge. The seventh male treated showed only slight decrease in the size of the glands. He had a strongly positive Kahn test. However, he returned to the clinic for antisyphilitic therapy only four times within the next three months. At that time both inguinal areas were indurated and there was drainage on the right.

One female presented bilateral inguinal adenopathy. At the time of discharge she had improved moderately but there was slight drainage on the right. When seen seven months later healing had taken place. The second female exhibited typical vulvar edema and ulcers. After four fever treatments the ulcers were entirely healed, but the size of the labia and the induration were apparently unaffected. The patient contended that she felt better during the series of treatments. Since radiant heat therapy has been discontinued in this case she has received intravenous typhoid shock therapy. No additional improvement has been noted and the patient complains that she does not feel as well.

Case Histories

CASE 1. — L. K., No. 59213. Colored male, 29. Admitted complaining of bilateral inguinal adenitis of 2 weeks duration. No penile lesion noted by patient. Headache, anorexia, malaise, vertigo, chills and fever accompanied adenitis. Had penile lesion 12 years previously and had received a few "arm shots." Physical examination revealed a marked bilateral inguinal adenitis; the glands were exquisitely tender and matted together; several small apparently fluctuant areas were present. There was evidence of bilateral indirect inguinal hernia. The Kahn test was strongly positive. Urinalysis was negative. The Frei test was positive. Attempts to aspirate the left inguinal glands were unproductive. During the first week the temperature was between 101 and 103.6 F. The patient was given neoarsphenamine in 0.6 Gm. doses. On the tenth hospital day he was given his first fever therapy. Three treatments were administered for a total of 9 hours of 105-107 F. over a period of eight days. The glands rapidly decreased in size and the patient left the hospital two days after the last treatment. Six weeks later he had a hernioplasty; the glands were of normal size. One year after treatment the patient was in good health and without any sequelae. He had not continued antiluetic therapy. Frei tests repeated at that time with mouse brain (Lederle) and ordinary type antigens were positive.

CASE 2. — Co. Ja., No. 58982. Colored male, 22. A painless swelling in the left inguinal region had become progressively larger and painful over a period of two weeks. No penile lesion had been noted. There were no constitutional symptoms other than a five pound weight loss during the present illness. The admission temperature was 99.8 F. Examination was essentially negative except for a firm, tender left inguinal adenopathy of hen's egg size. Urinalysis was negative. The Kahn test was negative. The Frei test was positive. Fever therapy was instituted two days after hospitalization. Four treatments were given for a total of 12½ hours of 105-107 F. over a 17 day period. The adenitis subsided and the patient left the hospital two days after the last treatment. He has not returned for follow up work.

CASE 3. — Ca. Je., No. 57364. Colored male, 28. Admitted with a painless swelling in left groin of two weeks duration. There was an associated fever and constipation. History for syphilis and gonorrhea negative. Physical examination revealed an acutely ill, feverish patient with findings limited to the left inguinal glands which were enlarged to the size of a goose egg, moderately tender, and somewhat adherent to a tense and red overlying skin, though there was no increase in local heat. The patient ran a moderate fever until immediately after the first fever treatment. The gland yielded upon aspiration a sanguinous, thin, purulent fluid. On the eighth hospital day fever therapy was instituted. Five treatments over a period of 22 days were given for a total of 10 hours of 105-107 F. The day following his fifth treatment he suffered a reaction characterized by abdominal pain, distention, nausea and vomiting and a rise in temperature. Blood count showed 12,000 W. B. C. with 86 per cent polymorphonuclear leukocytes. Urinalysis was negative. Blood calcium was 10.97 mg. per cent. These symptoms subsided with the parenteral administration of glucose and saline. In three days the temperature fell to normal by lysis.

The inguinal adenitis had disappeared and the patient was discharged eight days after his final treatment. No subsequent observation has been made.

Case 4. — L. S., No. 61707. White male, 18. Five weeks after exposure the patient developed a swelling in the left groin which gradually increased in size and became painful. Two weeks later he noticed a "pin head" sized sore surrounded by an erythematous zone on the penis. He was admitted 3 weeks after the onset of the adenitis. Malaise and fever had been present for an indennite time. Physical examination revealed a rather acutely ill boy with a red, tender left inguinal mass about 4 by 5 cm. in diameter and raised 2 cm. above the normal skin contour. The penile lesion consisted of a small grayish papule about which was a mildly erythematous zone — and within the week there was a typical generalized scabies. The urine was negative. The Frei test was positive. A Kahn test was negative. Until his first fever treatment, which was given on the tenth hospital day, the patient ran a moderate fever. It fell to normal immediately after and stayed there. Aspiration of the gland was followed by some drainage at the puncture site. Four treatments were received over a 12 day period for a total of 18 hours of 105-107 F. The glands responded nicely and the patient was discharged the second day following the final treatment. When seen one week later the glands were normal and the patient was in good health.

Case 5. — C. S., No. 53339. White male, 27. Admitted with tender bilateral inguinal adenitis of 5 weeks duration. No penile lesion was noted. The only systemic signs were weakness and weight loss. The patient had had a chancre 7 years previously and had received three months of intravenous and intramuscular therapy. Examination was not remarkable save for the inguinal glands which were enlarged, tender, and matted together, with several areas of fluctuation. There were a few condylomata acuminata on the penis. Urinalysis was negative. A Kahn test was negative. The spinal fluid was normal. The Frei test was positive. Fever therapy and Tamura's cultured antigen was given simultaneously, the latter subcutaneously 8 times in 0.15 cc. to 0.4 cc. doses over a period of 17 days. Fever therapy was begun on the fourth hospital day. Six treatments were given for a total of 22 hours of 105-107 F. during a 28 day period. The glands responded slowly and steadily; they did not break down. They were aspirated without obtaining pus on the twenty-third hospital day. Discharged two days after last fever treatment.

Case 6. — S. C., No. 61533. Colored male, 26. Two weeks after exposure the patient developed a swelling in the left groin. The swelling increased in size and became quite painful. Fever, headache, and night sweats accompanied the adenopathy. One week later (3 days before admission) an ulcer appeared on the foreskin. Physical examination revealed a moderately sick young man with a large, glistening, red mass in the left inguinal region. The mass was apparently fluctuant. On the foreskin was a soft-edged ulcer. Bubonulae were palpable along the shaft of the penis. The Kahn test was negative. The Frei test was positive. Many tiny pockets of pus were found when gland puncture was done. This pus was sterile upon culture. Fever therapy was instituted on the third day. Two treatments were given for a total of 3 hours of 105-107 F. over a period of 5 days. The penile lesion disappeared after the first treatment. The bubo decreased markedly and the patient went home the day after his second treatment. Upon examination over eleven months later the glands were perfectly normal to palpation and there was no induration. The Frei test was positive when repeated.

Case 7. — A. C., No. 61756. White male, 19. One week before admission painful bilateral swellings were noted in the groins. These gradually increased in size and there were anorexia, night sweats, headaches, and a weight loss of 10 pounds. No penile lesion was noted. Examination revealed several enlarged, tender, matted glands in both inguinal areas. No skin discoloration. There had been a traumatic amputation of the 4 smaller toes of the left foot. Urinalysis negative. Kahn test strongly positive. Frei test positive. Slight fever continued throughout his hospitalization. Neoarsphenamine was administered. Fever therapy was given on the seventh and fourteenth hospital days. The glands decreased in size and the patient left the hospital the day after his second treatment. He returned to the Fever Therapy Department two weeks later as an out-patient and received two more fever treatments for a total of 20¼ hours of 105-107 F. The glands almost completely subsided. He returned only infrequently for antiluetic therapy. When last examined 2 months later there was chronic induration of the left inguinal fold and drainage from the right inguinal glands.

Case 8. — E. B., No. 59982. White female, 32. This patient, who habitually lived with Negroes, developed a non-tender swelling in the right inguinal region 3 weeks prior to admission. She experienced mild chills and fever and was unusually constipated. Her physician prescribed some "drops" to take by mouth, but this medicament seemed to have little effect on the course of her illness except that she shortly developed an acneiform eruption on the face, back, and shoulders. Later a maculo-

papular erythematous rash appeared on the arms, palms, and torso. Examination revealed a large, firm mass of glands in right inguinal area over which the skin was tense and shiny. There were a few small left inguinal glands. Upon pelvic examination a lacerated cervix with dirty white discharge was found; otherwise negative. On the face and shoulders was an acneiform eruption while a maculo-papular erythematous eruption was seen on the arms, legs, palms, and torso. Urinalysis negative. Kahn test was negative. Cervical smears were positive for gonococci. Frei test was positive. She ran a febrile course for three weeks during which time the right glands also enlarged. Sterile pus was aspirated and drainage followed at the puncture sites. Fever therapy was instituted on the thirty-fifth hospital day. Five treatments were given over a period of 26 days for a total of 23⅓ hours of 105-107 F. The glands decreased in size but a slight amount of drainage was present on the right. On the second day after completion of fever therapy she was discharged. When seen 6½ months later the glands were normal, there was no vulvar edema, nor any anorectal symptoms.

CASE 9.—M. G., No. 76746. Colored female, 28. Onset of edema of vulva 8 months prior to admission. Ulcers appeared on right labia majora one month later and have been somewhat painful. Malaise and easy fatigue were only constitutional symptoms noted. Received 6 injections of arsphenamine 9 years ago. Examination reveals edema and induration of both labia majora, more marked on the right. Several shallow irregular ulcers present on the right labia majora. Clitoris hypertrophied and ulcerated. No ulcers seen on vaginal mucous membrane. Large granulomatous masses palpable within rectum but there was no stricture. A Kahn test was two plus positive. The Frei test was positive. The urine showed one plus albumin and many W. B. C. Blood count: W. B. C. 6,550 with 49 polys and 47 per cent lymphocytes. She was given neoarsphenamine intravenously. Fever therapy was begun on the eleventh hospital day. Four treatments were given for a total of 12 hours of 105-107 F. over a period of 14 days. The ulcers healed but the edema and induration were unaffected. She remained in the hospital for typhoid shock-therapy. No further improvement noted, although the patient said she felt better during fever therapy. Additional fever treatments are to be given.

Summary

A series of nine cases of lymphopathia venerea, eight of which were definitely in the acute stage and one subacute case, were given a course of treatment whose chief component was fever induced by radiant heat. Seven were males all of whom had an inguinal adenitis, either unilateral or bilateral, and exhibited a typical group of constitutional symptoms of varying degree. Six of these patients improved with an average of four fever treatments over a period of two to three weeks. One male patient to whom treatments were given over a period of a month presented indurated inguinal areas with unilateral drainage three months after therapy. He received two treatments while hospitalized and two as an out-patient. His Kahn was strongly positive and he received only sporadic antisyphilitic therapy. Two female patients were treated. The first, with bilateral inguinal adenitis, responded well to fever therapy. The second, with vulvar induration and chronic ulcers, responded only in that the ulcers healed. The edema and induration were apparently resistant to this therapy.

Conclusions

1. The incidence of lymphopathia venerea is increasing and the disease presents a clinical picture easily recognized by the alert clinician.
2. Early treatment is necessary if we are to effect cures.
3. In general therapy of all types has been either unsatisfactory or inconstant in effect.
4. The results obtained in a small series of nine cases using radiant heat fever therapy would seem to justify continued trial of this method.

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ROENTGEN THERAPY IN ACUTE MASTOIDITIS *

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Six years ago the author submitted a preliminary report on "The Apparent Therapeutic Effect of the Roentgen Ray on the Clinical Course of Acute Mastoiditis".[1] He stated that the roentgen ray frequently produced a change for the better in the clinical picture, the change occurring soon after and incidental to roentgenographic examination. This change for the better constituted presumptive evidence that the roentgen ray had exerted a beneficial biologic action on a radiosensitive lesion. Accordingly, the change was designated as "the syndrome of favorable action." Elicitation of the syndrome was considered as an indication that the lesion is radiosensitive and that conservative treatment is to be continued by x-irradiation. Failure to elicit the syndrome was considered as an indication that the lesion is not radiosensitive and not suited for roentgen therapy. Non-radiosensitive structures are always operable while radiosensitive ones very often are curable by roentgen therapy. However, some radiosensitive conditions were found by clinical experience to be more suited for surgery than for roentgen therapy. The circumstances that influenced the decision on surgical suitability were listed under "contraindications to roentgen therapy." Thus a line of demarcation was established between those cases best treated by surgery and those for which roentgen therapy might safely be used. Furthermore, it was suggested that the determination of radiosensitivity in cases of mastoiditis would reduce the incidence of operative intervention by the elimination of a high percentage of radiosensitive patients that were previously treated by surgery. Finally, it was suggested that the roentgen ray be employed as a prophylactic agent against mastoiditis in all simple suppurations of the middle ear.

In the period that has elapsed since the publication of the preliminary report, the author has not only been afforded many opportunities to observe, practice and confirm the concepts promulgated therein, but he has also been privileged to discuss these concepts intimately with numerous eminent colleagues.[2, 3, 4, 5]

The experience gathered from these observations and discussion makes it obvious that the greatest amount of benefit from roentgen therapy in acute mastoiditis will be derived only when the effectiveness of such therapy is recognized, its application standardized, and the proper discrimination practiced. The gist of this experience is presented with the hope that greater strides may be made in the attainment of that goal.

Recognition of Effectiveness of Roentgen Therapy

It is essential to recognize beneficial biologic action of the roentgen ray in mastoiditis, that a large percentage of cases is radiosensitive, and that the roentgen ray has a definite place in the management of this disease.

The usual clinical picture of acute mastoiditis is one with a history of primary suppuration of the middle ear for a period ranging from one to three weeks. The onset is accompanied by an elevation of temperature, pain in and about the ear, and tenderness over the antrum and tip of the mastoid. In the majority of instances these symptoms disappear with the appearance of discharge from the middle ear, but in a few cases they persist.

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A diagnosis of mastoiditis is inevitable when certain significant symptoms and signs appear in the course of an acute or subacute suppuration of the ear, particularly at a time when resolution of the infection has been anticipated. They are (1) pain over the mastoid, (2) insomnia or restlessness at night, (3) elevation of temperature, (4) a profuse purulent discharge, and (5) anorexia, listlessness and apprehension. Additional otologic signs occur in various combinations and constitute irrefutable evidence of suppuration within the mastoid. They are (1) persistent tenderness over the mastoid, (2) periosteal thickening, (3) loss of the postauricular fold, (4) edema about the ear, (5) displacement of the auricle, (6) enlargement and tenderness of the posterior chain of cervical glands, (7) rapid refilling of the canal on compression of the internal jugular vein, which is evidence of the presence of more pus than could be accommodated by the cavity of the middle ear, (8) contraction of the canal fundus, i. e., sagging, and (9) edema or nippling of the drum. In the infant, however, sagging seldom occurs and tenderness cannot be judged accurately; but nippling or herniation of the drum, a profuse discharge, and thickening of the periosteum constitute very suggestive signs.

At the time when signs and symptoms point to a diagnosis of acute mastoiditis, operation is commonly advocated. In the author's practice, a routine roentgen diagnostic examination is made of all cases of suppuration of the middle ear and mastoid, in order to determine the anatomic type of the latter, its radiosensitivity, prognostic features,[6] topography and extent of the pathologic process. Following this diagnostic exposure to the roentgen ray, and as its result, there occurs or there does not occur a phenomenon which determines the radiosensitivity of the lesion. When the lesion is sensitive, improvement of the clinical picture designated as "the syndrome of favorable action" takes place. When the lesion is not sensitive, the clinical picture is not altered.

The syndrome of favorable action may follow the exposure immediately or within 48 hours. It is characterized by (1) lowered temperature, (2) cessation of pain, (3) absence of insomnia, (4) lessened discharge, and (5) a change in the character of the discharge. The following interpretations of the individual factors in the syndrome are offered: (1) the lowered temperature is probably due to a diminution in the quantity of toxin, in the products of inflammation, and in the number of organisms that find their way into the blood stream; (2) the cessation of pain is probably due to a diminution of pressure within the individual cells of the mastoid and to a diminution or cessation of filtration of microorganisms and toxin through the mastoid cortex into the sensitive periosteum; (3) the absence of insomnia is probably due directly to the cessation of pain and throbbing; (4) the lessened discharge is probably due to more effective lymphatic drainage and to a reduction of the infection; (5) the change in the character of the discharge probably results from diminution of tension in the mucosa of the middle ear and antrum, whereby the mucous glands are more free to secrete and the secretion is better able to reach the surface. The addition of a mucoidal element to the bacteria and inflammatory cells already present permits a more effective ciliary action in the antrum and middle ear.

Accompanying the syndrome is a change in the mental attitude of the patient and a willingness or even a desire to partake of nourishment. Children become playful again. The change for the better is readily perceived. A similar change, less spectacular because it is slower, occurs in the otologic signs. Sagging disappears, patency of the canal is re-established, edema of the drum abates. The redness of the drum becomes less intense and gradually fades to a pinkish hue. Tenderness over the cortex is palpably diminished but sometimes persists for a few days. The feel of the periosteum

is thinner. The cervical glands are no longer tender, though palpable. The hearing function improves slowly.

Thus with the induction and perception of the syndrome, the beneficial biologic action of the roentgen ray is established.

In my most recent series of 100 consecutive cases of clinical mastoiditis, 64 were found to be radiosensitive, and were cured with roentgen therapy; 6 were not radiosensitive; 18 presented themselves with such an advanced stage that operation was imperative, and the remaining 12 had definite contraindications to roentgen therapy. Of the 18 advanced cases, there is a strong possibility that a certain proportion possessed a radiosensitive lesion earlier in the disease that may have responded favorably to roentgen therapy. Conservative estimates would place at least 70 per cent of all cases of clinical mastoiditis in the radiosensitive group.

In view of these figures, it becomes extremely important that clinicians be aware of the value of the therapeutic test for radiosensitivity, and avail themselves of the roentgen ray in suitable cases. Desjardins[7] commented that "roentgen therapy is not used as widely as it might be, probably because its value is not generally realized." Granger[8] concluded from observations following roentgenographic examination of mastoids in infants that the beneficial biologic action of the roentgen ray was "not a mere accident." Roberts[9] stressed the need for further study of the x-ray as a therapeutic and diagnostic agent, and he, too, observed an incidental and beneficial biologic action. Broudo,[10] Ross,[11] Lucinian,[12] Crain, Sloan and Stroud,[13] have attested to the value of roentgen therapy in mastoiditis.

Rationale of Roentgen Therapy

The exact nature of the favorable action of the roentgen ray in acute mastoiditis is not known. Regardless of whether a satisfactory explanation can be made, the fact remains that such action does occur. It is entirely unwarranted to withhold so valuable a therapeutic agent as the roentgen ray from a lesion that may be benefited by it, because of an inability to explain its action.

It is known that the roentgen ray is not bactericidal. It is also known that in small doses, the roentgen ray is prompt in its action, has a wide margin of safety, and does not produce any constitutional reaction. The total and differential leukocyte count in a few patients especially observed for blood changes while under roentgen therapy, did not vary beyond normal limits.

It is axiomatic that roentgen therapy for infections is most effective at the time of maximum leukocytic infiltration. This is so because the white blood cell, particularly the lymphocyte, is highly sensitive to the roentgen ray, and because the radiosensitivity of a lesion is in direct proportion to that of its predominant cells.

The progressive tissue changes in inflammation have been admirably described by Menkin[14] who showed that, following the development of any intense inflammatory reaction, a lymphatic blockade results and acts as a mechanical barrier. He considered the lymphatic blockade a basic reaction and felt that recovery was proportionate to the patency of the local lymphatics. Menkin declared that a marked fall in the pH of the tissue resulted in the death of the leukocytes and in frank suppuration.

These facts may well be applied to an analysis of what happens in an acute infection of the mastoid. The histopathologic changes are the progressive ones that occur in the mucoperiosteum lining the air cells and in the bone that forms the cell walls. At the onset of infection, the mucoperiosteum suffers inflammatory edema, capillary dilatation, and perivascular infiltration

by round and plasma cells. The hyperemia probably stimulates the bone beneath the mucoperiosteum to decalcification. This is the stage of hyperemia and infiltration. There follows capillary hemorrhage and blood clot formation within the cells. Polymorphonuclear leukocytes appear in abundance, ulceration of the mucoperiosteum occurs, the periosteum becomes thickened by proliferation of connective tissue, the blood clots disintegrate and pus is formed. This is the stage of suppuration.

A lymphatic blockade probably occurs between the stages of infiltration and suppuration. The lesion has probably reached the time of maximum leukocytic infiltration and the time of maximum radiosensitivity.

Some authors, in explaining the beneficial action of the roentgen ray, speak of "increased phagocytosis," others speak of "mass liberation of antibodies." An alteration in the vascularity of the area may also take place. It is likely that all these factors are stages of one mechanism which also includes other factors. Since the lymphatic blockade is characterized by plugging of the lymph channels with lymph, plasma and round cells, and since such cells are known to be highly radiosensitive, it is feasible that exposure to the roentgen ray initiates an unblocking of the lymphatics and re-establishes lymphatic drainage through the parotid, postauricular and retropharyngeal lymph glands. Furthermore, the roentgen ray possibly has an effect on the pH of the local tissues, thus preventing further frank suppuration.

When the beneficial biologic action of the ray is not in evidence, one may assume that the pathology in the mastoid has progressed beyond the stage of maximum leukocytic infiltration and early suppuration. Necrosis of the cell walls is probably taking place or has already taken place because of impairment of the nutrition to the bone by pressure within the cells, and the lesion is therefore no longer amenable to roentgen therapy. It is also possible that some lesions are not characterized by leukocytic infiltration and are therefore not radiosensitive.

Technic

Technical factors vary with each therapist. They require more uniformity and may then be varied specifically for each patient. In my experience the beneficial biologic action of the ray is obtained by 15 to 25 r, measured in air, with low voltage (60 to 80 K. V.), and filtered lightly with aluminum. The effect is not enhanced by larger amounts, i.e. more than 10 per cent of an erythema dose.

It is highly desirable that there be daily clinical observation until the acute symptoms subside and that daily exposure of the lesion to 5 or 10 r, after the induction of the syndrome, be given during such observation. As symptoms and signs subside, the frequency of exposure is lessened until such time as a cure is evident.

It is necessary to call attention to and emphasize the fact that evidence of a cure is clinical and not roentgenographic. On serial roentgenography there usually is continued decalcification for a period of one or more months beyond the time when the ear became dry. Return of aëration may be seen in one or two weeks after the ear is dry. Restitution of normal histologic structure as evidenced by a return of sharpness and whiteness to the outlines of the cells, is seldom visualized in the more severely infected types before six months after clinical cure. It is also noteworthy that sclerosis resulting from a recent lesion will not become evident for at least a year or more. A fact worth remembering is that roentgenographic evidence of recovery lags behind clinical evidence of recovery.

The age of the lesion, the extent of the pathologic process, and the severity of the infection modify the number of treatments necessary to pro-

duce a cure. In some cases resolution of the infection results from the original exposure to the ray. Nevertheless it is wise to repeat the exposure several times in the milder cases in order to hold an advantage over the infection. In the more severely infected cases it is best to obtain a cumulative effect from small daily exposures until all the symptoms are under control. Failure to control recurrent symptoms at any time during the course of roentgen therapy is an indication that surgical therapy is required.

The application of x-irradiation to several hundred cases of mastoiditis, with the above described technic, has not produced epilation or erythema in a single instance, nor has it interfered with subsequent growth and development of a young mastoid. Where such interference does occur, it is undoubtedly due to the infection.[15]

Contraindications

The roentgen ray is not a panacea for mastoid disease. Though the roentgenogram indicates the extent of pathologic involvement, it cannot indicate the virulence of the infection nor the clinical picture. It is therefore unreasonable to expect that operability of a mastoid lesion be determined by an x-ray film. But the correlation of the clinical picture with the x-ray findings does determine the therapeutic course. In other words, the manifestations which make operation imperative are clinical and not radiographic. On the other hand, certain radiographic signs render operation advisable.

The clinical manifestations and the radiographic signs which indicate operation and therefore contraindicate roentgen therapy are:

Clinical Manifestations:

1. Edema over the mastoid and displacement of the auricle, indicative of perforation of the cortex.
2. Transient edema in the region of the emissary vein (Griesinger sign), indicative of interference with circulation in the sigmoid sinus.
3. Torticollis, indicative of filtration of infection into the neck.
4. Swelling at and below the tip of the mastoid (Bezold abscess), indicative of perforation of the tip and gravitation of pus into the sheath of the sternomastoid muscle.
5. Failure to induce "the syndrome of favorable action," indicative of non-radiosensitivity or fulminating mastoiditis.
6. Signs and symptoms of invasion of the blood stream or of irritation of the dura or labyrinth.
7. Diabetes with roentgen evidence of bone destruction, even though the clinical picture is mild.

Roentgenographic Signs:

1. Extensive destruction, indicative of coalescence.
2. Progressive decalcification as seen on serial films, associated with low grade sepsis which threatens the recuperative powers of the patient.
3. A forward sinus, which extends more anteriorly than usual and obtains close relationship to the antrum. In this position the sinus plate is as vulnerable as a cell wall. Danger of complication of the sinus makes surgery advisable.
4. An undeveloped mastoid with some cells in the squama and tegmen, and evidence of infection of those cells. Undeveloped and partially developed mastoids with sclerosis are said to have an anatomic predisposition to intracranial complications. Such "candidates for intracranial infection"[6] should be carefully observed for signs and symptoms of extension of infection. They never present the classic clinical picture of mastoiditis. In the presence of persistent unilateral pain or headache, operation is imperative.
5. Cholesteatoma, which is neoplastic and never radiosensitive.

Conclusions

A surprisingly large percentage of mastoid disease is radiosensitive, manifested by a "syndrome of favorable action" following diagnostic exposure to the roentgen ray.

The determination of radiosensitivity in acute mastoiditis permits grouping into two therapeutic classes, the surgical and the non-operative.

For the large radiosensitive group roentgen therapy is highly effective.

For the small non-radiosensitive group, and exceptional cases in the radiosensitive group, surgical intervention is necessary.

By determination of radiosensitivity the criteria for roentgen therapy and surgical intervention become clearly defined. The proper application of roentgen therapy is not as a panacea, but a meritorious measure, markedly reducing the incidence of surgical intervention. Denial of roentgen therapy when it is contraindicated does not detract from its value in indicated conditions.

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Discussions

Dr. H. G. Reineke (Cincinnati): As a roentgenologist, I am gratified to have the matter of the pre-operative examination dealt with by the essayist. No one better than the roentgenologist knows that the preoperative mastoid examination is not absolutely diagnostic. In fact, many times, it is valueless for the diagnosis of mastoiditis, but serves to give the otologist the anatomy of the operative field. I am interested in the "syndrome of favorable action." This seems to me to depend largely on the presence of leukocytes in large numbers at the moment x-radiation is given, because this is the time of optimum sensitivity to roentgen rays. It is doubtless for this reason that the subjective symptoms are so promptly relieved. The contraindications as given by the author are eminently fair and certainly include every contingency. Crain and Sloan of Corpus Christi, Texas, have stated that there is no contraindication to x-ray therapy per se on the ground that no harm can come from it. Their implication that sound clinical

judgment in the study of each case is necessary is apparent, and that is exactly what Dr. Schillinger is doing when he outlines the clinical and roentgenographic contraindications for radiation therapy of mastoiditis. His sixty-four per cent of cures with x-radiation is certainly impressive. Crain and Sloan report an even higher percentage of cures, namely, 87.7, their average time factor being eleven, the longest fifty-one and the shortest four days.

The matter of dosage as given in this presentation interests me. At the Cincinnati General Hospital we have treated mastoiditis with good results but the doses have been larger. Our experience in this connection has been very limited as compared with Dr. Schillinger's. We have filtered our rays with four millimeters of aluminum and have used 120 KVP, administering as a rule about 100-150 r units per dose. This has been repeated in from three to five days as indicated. After listening to this most excellent presentation we shall cut down our factors with a view to duplicating these reported results.

Dr. R. L. Wetherington (Cookville, Tenn.): I would like the doctor to tell us whether or not those cases that are not radiosensitive might not partially be due to some infection of the paranasal sinuses, since it seems that a certain percent of those cases do have more or less infection of the paranasal sinuses, usually on the side in which the mastoid infection is found. I would like to ask that question, if it might not be due to something like that.

Dr. Noah Fabricant (Chicago): What percentage of radiosensitive mastoids will clear up without any roentgen therapy?

Dr. Walter A. Ford (Sheboygan, Wis.): Our passing on a case to say whether or not it is surgical has been largely based upon whether or not the tip cell was involved, of course, along with that the condition of the patient, and the organism causing the disease. But whether or not the tip cell is involved was a point that was brought out very strongly, I recall, by Granger of New Orleans. I want to ask Dr. Schillinger if perhaps the involvement of the tip cell would be a contraindication, even though it was not broken down so as to cause a swelling of the para-auricular tissue of the physiomastoid.

Dr. Raphael Schillinger (closing): Dr. Fabricant asked what percentage of radiosensitive mastoids will recover without roentgen therapy. Now that is a paradoxical question, because you do not know that a mastoid is radiosensitive until you have made your therapeutic test with the roentgen ray, and inasmuch as I stated that one exposure may cause a change in the clinical picture and recovery may follow, there is no way of determining such a thing. Once you apply the roentgen ray, you no longer are able to control and call that a case without roentgen therapy, because very frequently, both acute and chronic ears seem to be influenced by a single small dose of x-ray.

I have tried to run a control series in which some cases were not x-rayed at all and others were. My conscience did not permit me to run that series very long. I wanted to determine percentages, but I do not feel that percentages enter into a consideration of therapy in mastoiditis.

Dr. Ford asked about the tip cells. Unfortunately it is impossible to cover this subject as thoroughly as we should, in so little time as we have. At my exhibit, I show variations in the pneumatization of the mastoid wherein a fairly large percentage of cases has no tip cells; if you are going to use tip cells for operability or contraindication to roentgen therapy, and they are absent, your criteria are out. No two mastoids are alike. They differ as do finger prints or faces. There are variations in the development of mastoids. Some mastoids have tip cells only and no other cells. Others have considerable areas of pneumatization with failure of cell formation in the tip. Therefore, judging a mastoid by persistent tenderness over the tip, is good judgment when the sign is there, but if the sign never appears, it would be bad judgment.

Dr. Wetherington asked a very important question, but I am afraid that we cannot speak of radiosensitivity of a mastoid lesion in the same breath with infection of the nasal sinus. It is my opinion that all middle ear and mastoid infections are secondary to naso-pharyngeal infection. That is not an opinion individual to myself, but is an accepted conception of the pathogenesis of middle ear disease. During the inception of the infection, there was a paranasal sinus or rhinopharyngeal infection, but that may have cleared up, and this secondary lesion is flaring up. Failure to evidence radiosensitivity is entirely independent of the type of infection in the nasopharynx, and entirely independent of the presence or absence of an acute paranasal sinusitis at the time of test for radiosensitivity. However, it is important to remember that when you have done all you could locally for a recurrent or a chronic infection of the middle ear, or while you are doing all you can locally in the form of treatment, you should at the same time make not only an anatomic, but also a functional examination of the paranasal sinuses and their lining membrane for a focus of infection which may be responsible for the lighting up of the middle ear suppuration.

Concerning the histopathology of mastoiditis, I have stated that cases that are not radiosensitive and present signs and symptoms of acute mastoiditis must come to operation. Now, whether at any time in the past they were radiosensitive is hard to say by the histopathology of the specimens removed at operation. On the other hand, I have had to operate some cases that evidenced radiosensitivity, and in those cases sections showed a high leukocytic infiltration.

SCIENCE, NEWS, COMMENTS

Physical Therapy Section of New York State Medical Society Annual Meeting

Wednesday, May 11, 1938 — 10 a.m.
The Waldorf Astoria, Assembly Room N.P.R.
Chairman: MAIDE C. L. MCGUINNESS, M.D., New York.
Secretary: HAROLD J. HARRIS, M.D., Westport.

1. Physical Therapy in Smaller Hospitals.
Joseph A. E. Syracuse, M.D., Buffalo.
Discussion: Jerome Weiss, M.D., Brooklyn.

2. The Circulation of the Joints of Chronic Arthritis.
John W. Ghormley, M.D., and *Alexander Silverglade*, M.D., Albany.
Discussion: Edward F. Hartung, New York.

3. Prognosis in Peripheral Vascular Disease and Indications for Treatment.
William S. Collens, M.D., and *Nathan D. Wilensky*, M.D., Brooklyn.
Discussion: Karl Harpuder, M.D., New York.

4. Short Wave Diathermy — Clinical Application and Technic.
John S. Coulter, M.D., and *Stafford L. Osborne*, B.P.E., Chicago (invited guests).
Discussion: Gustav Bucky, M.D., New York.

5. Radio Interference by Electrical Equipment Used by Physicians and Surgeons and Means of Eliminating It.
Horatio B. Williams, M.D., New York.
Discussion: Myron Schwarzchild, Physicist, New York (invited guest).

The Combating of Rheumatism

At the International Congress on Rheumatic Diseases held in the University of Oxford from 28th to 31st March, 1938, Professor Ralph Pemberton of Philadelphia was elected President instead of the retiring President, Dr. R. Fortescue Fox of London, who did not wish to accept a new appointment as Council Member. The resigning secretary and director of the International Advisory Bureau, Dr. J. van Breemen, Amsterdam, at the urgent request of the meeting, expressed his willingness to remain in function for the present. The other Council Members were re-elected, while Prof. J. Rother of Berlin got a seat on the Council as Representative for Germany.

A Committee was appointed to collect statistics, to revise the by-laws and to reorganize the Journal "Acta Rheumatologica."

It was decided to accept the invitation of the American delegates to hold the next Congress at New York in June, 1940.

The official subject to be discussed will be: (1) The role of infection in rheumatic diseases; (2) Nutrition in rheumatism; (3) The social significance of orthopaedic work in rheumatic diseases.

It was also resolved to hold a symposium on therapy in rheumatism and to furnish opportunities for free papers.

First International Congress of Cosmobiology

The First International Congress of Cosmobiology will be held June 2 and 6 at Nice, France, under the honorary presidency of Professors d'Arsonval and Lumière. Sessions will be held in the university center and the city metereology office, in the museum of oceanography, in the anthropologic museum and in the International Hydrographic Bureau of Monaco. The last session will take place in the prehistoric caves of Grimaldi and the laboratory of Dr. Voronoff.

The scientific program will be published later, and a number of excursions and entertainments have been provided as part of the program.

All interested in this first congress will obtain detailed information by addressing the Executive Secretary of the American branch of the congress, Miss Edna Minsky, 120 East 37th street, New York City.

Vegetable Fats Found Digestible and Nutritious

Vegetable fats are completely digestible and they satisfactorily fulfill the needs of the body for fat, according to Dr. Harry Steenbock of the University of Wisconsin.

Dr. Steenbock and his associates at the Wisconsin Experiment Station have confirmed the finding made at other experiment stations that lack of fat in the diet of experimental animals results in abnormal symptoms, including the stopping of growth. They found that white rats suffering from want of fat could be completely cured in from five to seven weeks by feeding them daily five drops of corn oil, 15 drops of lard, or 20 drops of a widely known vegetable fat.

The Wisconsin investigators found that all edible fats, animal or vegetable, are completely absorbed by the body if they will melt below body temperature. Hydrogenation of vegetable fats does not make them indigestible, therefore, unless it is carried so far as to give them a melting point of 100 degrees or more. And this is not done with ordinary commercial vegetable fat.

Some fats are digested much more rapidly than others, Dr. Steenbock found. He pointed out, however, that it has not been proved that quick digestion is desirable, although it is popularly associated with "easy" digestion. Slowly digested foods have a certain value in that they tend to keep one from growing hungry before the next meal. — *Science News Letter.*

(*Concluded on page 307*)

ARCHIVES of PHYSICAL THERAPY
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

.·. EDITORIALS .·.

THE PROBLEM OF PERIPHERAL VASCULAR DISEASE

Ever since Medicine has been emancipated from medieval supernaturalism, the factors constituting the difference between the Art and Science, or the practice and the theory, have often lacked adequate correlation. This was in a great measure attributed to a desire to explain pathologic problems and an innate willingness to accept the wish as scientific truth. Theories so developed have never lived beyond experimental evidence. Such a circumstance strikingly applies to the grave morbidity associated with certain types of peripheral vascular disease. Efforts to influence them by measures calculated to produce counter-irritation or derivantia have not been consistently impressive to warrant more than the suggestion that the solution of the problem is close at hand and but needs the continued cooperation of the laboratory and bedside to reduce their control to a rational basis.

The fact that this year marks the centenary of a new thought; namely, the introduction of the application of environmental air pressure by Junod for the purpose of influencing the peripheral circulation, adds sentiment to the present interest displayed about the problem of peripheral vascular disease. The well known Junod "boot" actually is the forerunner of the present more complicated appliance used in the treatment of obliterative vascular affections of the extremities. The theory advanced by Junod and his enthusiastic followers can be reduced to the term hemospasia, which essentially was purely a development of the time honored effects expected from simple cupping. Unfortunately, the advocates of this new method gradually experienced clinical failures because of their inability to evaluate the therapeutic indications on a physiologic basis. It was not until about the end of the last century that the epochal studies of Bier reduced the problem of hyperemia in various forms to physiologic principles. It is noteworthy, however, that while Bier developed Junod's appliances for the purpose of securing properly controlled mixed hyperemia in the extremities, and even recognized that they effected a sort of exercise of the peripheral circulation, he preferred active or arterial hyperemia by dry heat in the clinical management of incipient diabetic gangrene and arteriosclerosis. There is evidence that he placed the mixed hyperemia resulting from the thinning of environmental air on a par with congestive hyperemia produced by elastic constriction of the extremities. To stimulate local circulation arterial hyperemia was accepted by him as more promising in pathologic changes of the blood vessels. The underlying principles enunciated by Bier have been recognized as practically axiomatic for any form of therapy of a nature to produce hyperemia which also includes the present application of diathermy.

The question suggests itself why Bier's teaching and Junod's earlier works have not received universal acceptance, especially for the management of obliterative vascular disease. There is no doubt that to a certain extent the influence of bacteriotherapy and chemotherapy were so spectacular in their promise as to overshadow the more mechanical procedures. If these measures had proved as effective as their promises, they no doubt would have remained the method of choice. Their inadequacy however compelled revaluation of the older principles of therapy which led to the perfection of mechanical exercise and passive hyperemia along the line more recently

pointed out by Herrmann.[1] This, too, not having proved a panacea and having revealed certain limitations both in its mechanical and clinical aspects, stimulated the search for simpler and more effective methods. For this purpose the clinic and laboratory have recently been drawn upon to overcome the disadvantages incident to older and present day procedures.

From a clinical point of view the ingenuity of modern investigators has attempted to elucidate the mechanism which influences the blood and vascular changes associated with vasospasms and organic alterations of the vessel walls. In these studies presented elsewhere in this issue it is evident that both Collens, Wilensky and Ginsburg,[2] for the clinical aspect, and Harpuder, Stein, and Byer,[3] for the laboratory phase present results based partly on a more exact determination of the underlying processes and the application of intermittent or shunt of the blood vessels which appear to be of practical value, at least in certain forms of endarterial disease. Their reports convey the additional information that correlates the clinical and experimental factors with the physiologic response in the form of vasodilation and hence increased local circulation. Harpuder has experimentally substantiated the effect of vascular exercise on the blood constituents by the use of compression with a rubber cuff combined with muscular exercise under ischemic conditions. As a result of these observations he has proved the possibility of inducing arterio-venous anastomosis entirely apart from the favorable effect on the capillaries. Carried to a logical conclusion, the simple exercises suggested appear to be capable of favorably influencing certain types of pathologic vessel conditions which in the past have proved refractory to the other methods of therapy. The work of Collens and his associates by clinical and plethysmographic studies reveals the possibilities incident to simplified environmental pressure, facilitating intermittent occlusion and release. It is more than likely that the combined application of short wave diathermy with the mechanical procedure has enhanced the therapeutic results.

These studies mark an important advance in the management of certain types of endarteritis. One can visualize still further simplification of the appliances to produce equally good results. Possibly some modification of Bier's elastic bandage acting as a condenser electrode during its use in short wave diathermy may yet prove adequate for this purpose, which would eliminate the present costly and cumbersome equipment, as already evident from Collens' appliance. In the last analysis these contributions are important collateral studies along the lines originated by the contributions of Junod and Bier. With the laboratory method now available and utilized new paths may lead to a definite solution of the important problem of adequately controlling peripheral vascular disease.

References

1. Herrmann, Louis G.: Passive Vascular Exercise, Philadelphia and London, J. B. Lippincott Co., 1936.

2. Collens, William S.; Wilensky, Nathan D., and Ginsberg, Hyman: Intermittent Venous Occlusion in Peripheral Vascular Disease. Study of Its Physiologic Mechanism and Therapeutic Effects, Arch. Phys. Therap. **19**:261 (May) 1938.

3. Harpuder, Karl; Stein, I. D., and Byer, J.: Effect of Arterio-Venous Shunt in Peripheral Vascular Disease, Arch. Phys. Therap. **19**:272 (May) 1938.

ELECTROSURGERY

Electrosurgery may be considered under three divisions: (1) time-honored electrocauterization; (2) surgical ionization, now seldom used; and (3) surgical diathermy, which is most important. Electrocauterization needs little description as the principles underlying its use are well known to all surgeons. Surgical ionization plays a minor role in the treatment of superficial lesions and in the process of epilation.

Destruction of tissue is brought about by concentration of caustic acid or alkaline ions in the tissue in contact with a needle, through which a constant electric current is allowed to pass.

The electrocautery destroys tissues by conduction of heat from this hot loop to the tissue. Surgical diathermy, on the other hand, utilizes an electric current of high frequency; this current will not produce an electric shock if allowed to pass through the tissues of the body, rather it produces destruction of the tissues because they offer resistance to the flow of the current. When the current is concentrated in the tissues at the tip of a needle, varying degrees of endogenous heating, or even actual disintegration of tissue will occur when the tip is applied to it. Unlike the cautery, the needle at the end of a surgical diathermy handle is constructed of metal of low electrical resistance. The needle, therefore, remains comparatively cold, but the tissue near the needle or in contact with it offers resistance to the flow of the current from the needle. The tissue, therefore, is heated or desiccated. Surgical diathermy is so frequently regarded as a form of cauterization that an explanation of the differences in the mechanism involved seems essential. Not only are the cautery and surgical diathermy entirely different in construction and effect, but also the accuracy of control of the latter is much more delicate than that of the former.

Monoterminal application of surgical diathermy, in which the active needle is attached to a single terminal of the diathermy machine by an insulated wire, is spoken of as "fulguration" or "desiccation."

Biterminal application of surgical diathermy consists of attaching the needle to one terminal of the diathermy machine by an insulated wire. A large "indifferent" plate is placed in contact with the body of the patient at some site remote from the lesion. This is attached by means of a wire to a second terminal of the diathermy apparatus. Biterminal applications are used in electrocoagulation and in electrosurgical cutting.

High frequency oscillating current used in fulguration, electrodesiccation and electrocoagulation is a damped current. On the other hand, high frequency oscillating current used for cutting tissues, is undamped; that is, the amplitude of successive vibrations does not vary from the maximum. Such an undamped current is usually produced by means of the tube (or valve) type of diathermy machine. Whereas a damped high frequency current tends to coagulate tissues, an undamped current causes actual disintegration which results in solution of continuity of tissues; this latter type of current is called the "cutting" current.

Surgical diathermy has proved particularly efficacious in certain surgical procedures, and in time, as new technics are developed, it will undoubtedly be more extensively used. Already it has acquired a definite place in the field of neurosurgery. Cushing was an enthusiastic advocate of electrosurgery, and Adson applies it routinely for hemostasis in various types of neurosurgery.

Kirschner, of Germany, published reports of 250 cases in which electrosurgery was used. He advocated its use, particularly in amputation of the breast for carcinoma, and in operations on the thorax, especially in resection of a rib or in thoracoplasty. Heymann observed that electrosurgery was effective in incision and enucleation of furuncles and carbuncles, and in the eradication of extensive collections of purulent material. Hesse was of the opinion that electrosurgery is of special value in the treatment of malignant diseases of the nose and throat, particularly small malignant growths of the larynx and of the maxillary sinuses.

A number of authors, Mock, Tinker, Jackson, and Heymann have enthusiastically advocated the use of surgical diathermy in operations on the thyroid gland, particularly in operations necessitated by the presence of malignancy or toxic exophthalmic goiter.

Certainly, electrosurgery should merit the continued interest of all surgeons. — [*Frank H. Krusen,* M.D., Editorial, Surg. Gynec. & Obst. **66**:248 (Feb. 1) 1938.]

WESTERN SECTIONAL MEETING

The Western group is to be congratulated on the splendid program it has prepared for its mid-year session. The Board of Governors of the Congress owes a debt of gratitude to those of its Western members who constantly work not only for the welfare of the parent organization but for the cause of physical therapy generally.

Physical therapy has made rapid strides during the past decade. It must not be overlooked that the West has contributed its share in scientific re-

search in this field and that no small part of the success which has been achieved is attributable to Western workers. The Congress is particularly pleased in observing the cooperation which the western section is receiving for its June program from physicians from other parts.

For those who find it possible to attend the Los Angeles meeting of the Western Section, assurance can be given that the time will be spent profitably. With the American Medical Association meeting immediately following, in San Francisco, the indications are for a very large attendance, since, no doubt, many will arrange to attend both sessions — proximity in time and location being an attractive feature.

For those who have not had knowledge of the Los Angeles gathering, we suggest that they rearrange their schedule. The program which both the Western Section and the Pacific Association are offering is a strong one — one which will definitely impress you with the scope and importance of physical medicine in scientific therapy.

Technician Examinations

Examinations, Senior and Junior grade, for Registered Physical Therapy Technicians are now being arranged for the month of June in Chicago, New York City, and Washington, D. C. If there is sufficient demand, examinations will be held in other localities. For application, address American Registry of Physical Therapy Technicians, 30 North Michigan Avenue, Chicago, Illinois.

Science, News, Comments

(*Continued from page 302*)

Meetings of Physical Therapy Organizations

In this permanent column will be published information about meetings, election of officers, etc., of physical therapy organizations. New data should be sent promptly to the office of the Secretary, 1100 Park Avenue, New York.

American Congress of Physical Therapy, and American Occupational Therapy Association; Palmer House, Chicago; September 12th to 15th; Dr. Richard Kovács, 1100 Park Avenue, New York, Secretary, American Congress; Mrs. Meta R. Cobb, Executive Secretary, Am. Occup. Therap. Assoc., 175 Fifth Ave., New York.

Special Instruction Seminar, September 7, 8, 9, 10, 1938, preceding 17th Annual Session, American Congress, Palmer House. For detailed information see announcement elsewhere this issue.

Physical Therapy Session; New York State Medical Society, New York City, May 11th. Madge C. L. McGuinness, M.D., Chairman; Harold J. Harris, M.D., Westport, N. Y., Secretary. (See announcement program this issue.)

Western Section of the American Congress of Physical Therapy and Pacific Physical Therapy Association, 6th annual session, June 9 and 10, 1938, Los Angeles County Medical Association Building, Los Angeles, Clinton D. Hubbard, M.D., Secretary, Huntington Park, Calif. (See announcement program this issue.)

Special Meetings; Special Committee on Physical Therapy, New York County Medical Society. John D. Currence, M.D., Chairman.

Pennsylvania Physical Therapy Association; meetings at the Philadelphia County Medical Society Building, third Thursdays from September to June; Dr. Arno L. Zack, 216 East Broad Street, Bethlehem, Pa., Secretary.

Pacific Physical Therapy Association; meetings at Los Angeles County Medical Association Building, fourth Wednesday. Clarence W. Dail, M.D., Sec'y., Treas., Loma Linda, Calif.

Kings County Medical Society, Physical Therapy Section; meetings at 1313 Bedford Avenue, Brooklyn, bi-monthly on second Thursdays; Dr. H. T. Zankel, 5 St. Paul's Place, Brooklyn, Secretary.

New England Physical Therapy Society; meetings at Hotel Kenmore, Boston on third Wednesdays from October to June; Dr. William McFee, 41 Bay State Road, Boston, Mass., Secretary.

New York Physical Therapy Society; meetings on first Wednesday from October to May; Dr. Madge C. L. McGuinness, 1211 Madison Avenue, New York, Secretary.

New Theory of Relativity Announced by Yale Scientist

A new theory of relativity, presented as a more effective mathematical tool than the famous Einstein theory, is offered to the world of science by Prof. Leigh Page, widely-known theoretical physicist of Yale University. The new theory is expected to be useful in interpreting the atom. It will have no effect on large scale happenings.

While Prof. Page does not say so, the effect of changing the relativity theory may be likened to proposals for changing the Supreme Court, for relativity has been pictured as the supreme court of science before which all physical laws and theories must be judged.

Prof. Page states in his report:

"The author believes that Einstein's postulate is too restricted to include all possible motions of material particles. In this paper the author will present an alternative theory, and will give reasons for believing that it, rather than Einstein's theory, represents the proper formulation of relativity in an effectively empty world."

Prof. Page broadens Einstein's relativity theory by proving the following result:

"It is shown," he says, in summarizing his work, "that in an effectively empty world Einstein's assumption of an invariant physical interval and an absolute four-dimensional space-time is in contradiction with the underlying principle of the relativity of motion, and therefore either the one or the other must be abandoned."

Which is saying in effect that either one or the other of the two basic "planks," on which the entire structure of Einstein's relativity theory is built, is fundamentally unsound.

As a very broad theory of science which has permeated nearly all fields of physical research, the relativity theory has more than a rough analogy to the Supreme Court of the United States.

As Prof. W. F. G. Swann has explained regarding the value of Einstein's relativity theory to science:

"The theory of relativity serves as a sort of supreme court to which we may present our proposed theories, our proposed laws of nature, for validation. The theory of relativity cannot, in general, discover the laws for us, but it can act as a useful guide in helping us to our choice."

Prof. Swann points out further the basic conclusion of relativity theory that, in no way, is it possible to detect absolute motion in space. If a theory of science on atoms, gravitation or anything else indicates that such an experiment should be possible, either relativity theory is wrong or the proposed theory is wrong. In this sense the relativity theory is a supreme court where the laws of nature are put to test. While it does not suggest new laws, any more than the Supreme Court of the nation does, the relativity theory, like the Supreme Court, serves as a hurdle which all physical laws must surmount to be accepted into the realm of science. — *Science News Letter.*

THE STUDENT'S LIBRARY

EINFUEHRUNG IN DIE KURZWELLEN-THERAPIE. BEHANDLUNGSTECHNIK UND INDIKATIONEN (Introduction to Short Wave Therapy. Technic and Indications). Von Dipl.-Ing. *Ernest Fritsch* und Dr. med. *Martin Schubart*, Berlin. 2nd enlarged edition. Cloth. Pp. 200 with 117 illustrations. Price RM. 5.50. Berlin and Vienna: Urban & Schwarzenberg, 1938.

It is evident that in German-speaking countries the interest in short wave diathermy by general practitioners is widespread, for there are already several small manuals on this subject published in Germany and Austria. As the title implies the present small book may be regarded as a primer, though as a matter of fact the text embraces a considerable range and includes much of the literature that has appeared on the problems of this form of physical therapy. The book differs from the other similar works in that it devotes one chapter to fever therapy by short wave diathermy, and another, written by the ophthalmologist Gutsch, of Berlin, on the treatment of a number of diseases of the eye. The well known engineer Esau has prepared a short introduction in which he makes the claim that it is due to the development of the 6-meter apparatus in Germany that other countries have abandoned the production of 10 to 20 meter apparatus in favor of the former, and that therefore the path taken by German physicists and physicians has been universally acknowledged to be correct. The text proper takes up the physical fundamentals discusses the apparatus and electrodes, the biologic effects and the indications of short wave therapy and its technic in the diverse diseases. A small pamphlet separate from but placed within the book is providing the various rules to be observed in the treatment of patients. Bibliographic references are given by separate subjects and years. A good index concludes this practical book. The authors have introduced the problem of selectivity but have fought shy of that of specificity which has been claimed by several workers abroad. The main value of the book lies in the painstaking attention to details of technic in treatment.

FRACTURES AND DISLOCATIONS FOR PRACTITIONERS. By *Edwin O. Geckeler*, M.D., F.A.C.S. Cloth. Pp. 252 with 213 illustrations. Price $4.00. Baltimore: William Wood & Company, 1937.

The title of this book should have been given as Fractures and Dislocations for General Practitioners clearly to indicate for which class of readers the book has been prepared. The art of properly caring for injuries resulting in fractures and dislocations has become so complicated that a large tome barely suffices adequately to discuss all phases, and several large volumes have appeared within recent years that attempt to be all-inclusive. Unfortunately general practitioners have not the necessary leisure to wade through more than a thousand pages, and it is therefore praiseworthy that the author, the well known Philadelphia orthopedic surgeon, has presented a small manual which can be accepted as a safe guide to the proper diagnosis and rational management of the injuries under consideration. In a short chapter under the heading of "Follow-up Treatment" (chapter VI) a few lines are devoted to physical therapy and occupational exercises to enhance functional results. The technic of treating fractures is in accord with the latest and accepted methods. Similarly the difficult subject of dislocations takes up a special part of the book. Each chapter has a comparatively large list of bibliographic references. Paper, print and illustrations are excellent. The book should be in the hands of every practitioner who may be called upon to render assistance to patients who have sustained injuries with resulting break in the continuity of any part of the osseous system or disarrangements of the articulations.

J. B. MURPHY, STORMY PETREL OF SURGERY. By *Loyal Davis*, M.D., M.S., Ph.D., Professor of Surgery and Chairman of the Division of Surgery in Northwestern University. Cloth. Pp. 311. Price $3.00. New York: G. P. Putnam's Sons, 1938.

This is the biography of one of the world's great surgeons. John Benjamin Murphy was born in a frontier log cabin at Appleton, Wisconsin, in 1857. From this humble beginning "J. B." came to Chicago and grew in size. He worked his way through school and then medical school, continued his studies in Germany, and then returned to Chicago. Here his skill and his perseverance won him patients, and his Irish temperament and his independence of thought aroused the ire of his colleagues. He had the ability or the misfortune to continually make newspaper headlines from the time he worked all night on the victims of the Haymarket Square Riot of 1886 to the treatment of former President Roosevelt, in 1912. He was accused of charging exhorbitant fees, and the general practitioners were vehement in their stories of his having stolen patients from them. He contributed handsomely to the knowledge of surgery. In 1892, he did epoch-making work in intestinal surgery by the Murphy button for intestinal anastomosis. In 1897, he introduced end-to-end suture of blood vessels by means of invagination. Artificial pneumonthorax was introduced into America by Murphy in 1898. He was the recipient of numerous honors from Europe and America, but through it all the Chicago Medical Society refused membership to the "Stormy Petrel of Surgery." Finally he was asked to join, and he did. Shortly after, in 1910,

the American Medical Association elected him president. This story of a successful surgeon who was the fourth professor of surgery at Northwestern University Medical School is told by another successful surgeon who is the eighth professor of surgery at Northwestern. This book is most interesting and is highly recommended.

THE PRACTICE OF UROLOGY. By *Leon Herman*, B.S., M.D., Professor of Urology, University of Pennsylvania, Graduate School of Medicine; Urologist to the Pennsylvania Hospital and to the Bryn Mawr Hospital; Consulting Urologist to the Methodist Episcopal and Burlington County (New Jersey) Hospitals. Cloth. Pp. 923 with 504 illustrations. Price, $10.00. Philadelphia and London: W. B. Saunders Company, 1938.

This volume is a practical treatise on diseases of the urogenital system intended for the use of the general practitioner and surgeon. It is divided into nine parts, considering diagnosis; instrumental therapeutics in urology; the kidney; the ureter; the urinary bladder; the urethra; the penis and scrotum; the testicle, spermatic cord and seminal vesicle; the prostate gland; urolithiasis; and urogenital tuberculosis and actinomycosis and urinary syphilis. The author has had an extensive clinical experience and this book is a record of this experience. It is especially valuable to the general practitioner because considerable space is devoted to diagnosis and to the methods and procedures employed daily in treatment. The author has evaluated in an excellent manner the controversial problems of this subject. This volume is written in a scholarly manner and is excellently illustrated. It is highly recommended as a text book for students and as a practical treatise on the practice of urology for the general practitioner and surgeon.

INFANTILE PARALYSIS AND CEREBRAL DIPLEGIA. Methods Used for the Restoration of Function. By *Elizabeth Kenny*, with Foreword by *Herbert J. Wilkinson*, Professor of Anatomy and Dean of the Faculty of Medicine, University of Queensland. Cloth. Pp. 125 with 45 illustrations. Price 21/7. Sydney, Australia: Angus & Robertson, Ltd., 1937.

This book provides a detailed discussion of the author's method of treating infantile paralysis and cerebral diplegia. Apparently Kenny gives a more efficient, thorough and intensive treatment of these cases under the most suitable conditions than is usually possible. The method of treatment is based on the following principles: maintenance of a bright mental outlook; maintenance of impulse; hydrotherapy and remedial exercises; maintenance of circulation; and avoidance of generally accepted methods of immobilization. In the use of underwater exercises Kenny believes that individual tanks should be used, because in the larger pools it is impossible to obtain the same degree of cooperation between the patient and the technician; and a newly acquired movement may not be perceived as soon as it may be by the method of individual tanks and through this oversight, may be overtaxed and so weakened. Her principle of the avoidance of the generally accepted methods of immobilization certainly would be questioned by those treating infantile paralysis in this country. It is the author's belief that the paralyzed limbs should be allowed to remain in their natural position between exercises. This natural position is approximately the position of the body when a standing pose is maintained with the feet slightly apart and the hands by the sides. There are a number of excellent descriptions and illustrations of apparatus used in the treatment of infantile paralysis and cerebral diplegia. This book should be read by everyone treating infantile paralysis and cerebral diplegia.

ARTIFICIAL FEVER, PRODUCED BY PHYSICAL MEANS, ITS DEVELOPMENT AND APPLICATION. By *Clarence A. Neymann*, A.B., M.D., F.R.S.M., Associate Professor of Psychiatry, Northwestern University Medical School, Honorary Professor of Medicine, National University of Mexico, C.R.B. Exchange Professor of the Universities of Ghent, Liege, Louvain and Brussels, Belgium. Cloth. Pp. 294 with 68 illustrations. Price, $6.00. Springfield, Illinois: Charles C. Thomas, 1938.

Hyperpyrexia produced by physical agents is a new field in physical therapy, although various applications of heat which must have produced fever were used empirically from ancient times. The second chapter gives an interesting history of this subject. The physiology of hyperpyrexia and a comparison of the fever produced by external heat and by high frequency currents are considered in the third and fourth chapters. As Neymann and Osborne published their first work on electropyrexia in September 1929 it is natural that most of the volume is devoted to a discussion of this method of producing fever. Chapter five is on the technic of electropyrexia. The remaining chapters are devoted to the diseases which the author and other workers at Northwestern University have treated by fever produced by high frequency currents — dementia paralytica, syphilis of the central nervous system, primary and secondary syphilis, multiple sclerosis, chorea minor, arthritis, gonorrhea, and asthma. This is a most complete monograph on electropyrexia and can be highly recommended.

DIAGNOSTIK CHIRURGISCHER ERKRANKUNGEN. Mit Einschluss der Differentialdiagnostik und Roentgendiagnostik. Lehrbuch fur Studierende und Aerzte (Diagnostics of Surgical Diseases. Including Differential and X-Ray Diagnosis. A Text Book for Students and Physicians). Von Prof. Dr. *Rudolf Demel*. Chief of the Surgical Department of the Hospital Rudolf Foundation in Vienna. Second Edition. Cloth. Pp 863, with 847 illustrations in the text and 82 in 24 plates. Price, Rm. 20. Vienna: Wilhelm Maudrich (American Agency, Chicago Medical Book Co., Chicago), 1937.

The favorable opinion expressed in a review of the first edition in the Archives (May, 1935), has been proved justified, as can be seen from the fact that in spite of the poor economic condition, which especially affected German speaking countries, the entire first output has been sold out. Professor

Demel thereupon revised the present edition without, however, having undertaken any radical changes. In fact there was no need for them. So far as size and bookmaking are concerned, they are virtually identical with those of the first publication. Only a number of illustrations have been added at the suggestion of general practitioners, to facilitate the differential diagnosis of a number of surgical affections. It will be noted that the large sale has enabled the publisher to reduce the price of the book from 30 to 20 marks, in spite of the added cost of production. Since the subtitle is somewhat misleading, it should be stated that while the book does contain a large number of x-ray photographs, these are simply illustrations to facilitate the diagnosis of the conditions, injuries or malformations described in the text. In other words such x-ray illustrations have been selected as the average surgeon requires to confirm a diagnosis in doubtful cases. We can only reiterate what we have implied in the first review; namely, that this work is practical and therefore meets the needs of students and all practitioners interested in the proper recognition and correct diagnosis of the surgical diseases commonly encountered in daily practice.

THE THINKING BODY. A STUDY OF THE BALANCING FORCES OF DYNAMIC MAN. By *Mabel Elsworth Todd*. Foreword by *E. G. Brackett*, M.D. Cloth. Price $4.00. Pp. 314 with 91 illustrations. New York and London: Paul B. Hoeber, Inc.; Medical Book Department of Harper & Brothers, 1937.

This volume contains a complete discussion of the whole problem of posture and locomotion. There is an excellent presentation of the theory that form follows function. The reactions of the body to the forces of gravity and inertia, and the mechanical forces of the body are discussed in an original manner. The chapters on balancing forces in standing and walking should be read by everyone interested in good body mechanics. Unfortunately the exposition is interwoven with such highly colored and descriptive efforts as to reduce the formality of this important thesis to the suspicious level of so-called poetic license. An example in point is the following paragraph —

> Imagination itself, or the inner image, is a form of physical expression, and the motor response is the reflection of it. Memory records the reaction, as noted by Proust when, recovering himself from stumbling over uneven flagstones in a courtyard, he received a sudden release from gloom and discouragement, and upon analysis related it to a happier time, when the same thing occurred to him before the baptistry of St. Mark's in Venice he notes, "from caverns darker than that from which flashes the comet which we can predict — thanks to the unimaginable defensive force of inveterate habit, thanks to the hidden reserves which by a sudden impulse habit hurls at the last minute into the fray — my inactivity was aroused at length."

In scientific discourse a verbofuge style tends to distract attention from the essence of the subject and the conclusions of the contribution. It is like overloading substantial food with too much condiment. In the end one tends to develop a mental indigestion without benefit of the nutrient properties of the basic food. This volume will be found interesting reading, but one questions its value under its stylistic format.

Hyperpyrexia of Lymphopathia Venerea — Tauber and Squires

(*Continued from page 291*)

2. Clyne, I. M.: Lymphopathia Venereum, with Special Reference as to Treatment, Urol. & Cutan. Rev. **41**:177 (Mar.) 1937.

3. Hellerstrom, S.: Injections Intraveineuses avec l'antigène de la lymphogranulomatose inguinale, Acta dermato-venereol. **17**:293 (Aug.) 1936.

4. Tamura, J. T.: Cultivation of Virus of Lymphogranuloma Inguinale and Its Use in Therapeutic Inoculation; Preliminary Report, J. A. M. A. **103**:404 (Aug. 11) 1934.

5. D'Aunoy, R., and von Haam, E.: Virus of Lymphogranuloma Inguinale, South. M. J. **29**:911 (Sept.) 1936.

(Discussions on this article will be published in an early issue. — ED.).

INTERNATIONAL ABSTRACTS

Short-Wave Therapy in Gynecology and Obstetrics. Edward G. Waters.

Am. Obstet. & Gynec. **35**:143 (Jan.) 1938.

Interest in the possibilities of short-wave therapy in obstetrics and gynecology was aroused by its presumed ability to produce heat for conditions and in locations otherwise inaccessible to it in the usual form. In the several conditions it had long been felt that if heat could be applied adequately, safely, and easily, much benefit would be derived. It was decided to use short-wave therapy in such conditions as might conceivably benefit from tissue heat and the physiologic tissue changes resulting therefrom. All of the treatments were given to patients in the hospital and under careful supervision.

Sixty-four patients who presented as the outstanding symptom infected and foul lochia, were observed and treated with short-wave therapy. Many of these were accompanied by tenderness of the uterus, and several were complicated by very high temperature and pelvic pain. The foul lochia cleared in all but four of these sixty-four and in two cases the patient's condition progressed to general sepsis.

Seven of eight cases of subinvolution of the uterus responded promptly to therapy, although three patients had been treated by the usual oxytocics without response. In one case there was a marked increase in bleeding amounting to hemorrhage, and this patient was subsequently found to have a large intrauterine piece of retained placenta.

In ten cases of dysmenorrhea treated, the results were less startling. Four failed completely to be relieved. None of these four showed gross pelvic abnormalities to account for the dysmenorrhea. In the six patients who had complete relief, the pain recurred in four at subsequent menstrual periods. However, in three of these four repetition of the treatment again affected temporary relief.

The most constant results were obtained in myalgias of the extremities, back, and neck, where the response was early and permanent and with a minimum number of treatments.

In the twelve cases of breast abscess, better results were obtained than the figures indicate. Seven of these entered the hospital for incision and drainage, but the subsequent course could be fairly described as being less painful and associated with more rapid convalescence than one would ordinarily expect.

Ten patients with phlebitis were treated and clinical cure effected in nine. The average period of disability was not much shorter than with other forms of therapy, but the relief to the patient came earlier and was more definite and lasting than those observed and treated by other methods.

Artificial Fever Therapy of Sydenham's Chorea. H. W. Kendell, and W. M. Simpson.

Ohio State M. J. **33**:1097 (Oct.) 1937.

Kendell and Simpson have subjected five patients suffering from Sydenham's chorea to artificial fever therapy, using the Kettering hypertherm. All experienced prompt cessation of choreiform movements. None have had recurrence. There were four females and one male. The duration of chorea prior to administration of artificial fever ranged from ten days to three weeks in the four severe cases, and in one mild case there had been repeated attacks for one year before artificial fever therapy was given. These patients were given from one to eleven treatments, the average single fever session being three hours between 104 and 105 F. The period of observation extends from six weeks to four and one-half years. In addition to the choreiform movements, three patients showed evidence of carditis as demonstrated by mitral murmers, electrocardiographic changes and tachycardia. The mitral murmers disappeared in all following treatment. The normal cardiac rate and rhythm was restored. Two patients had polyarticular arthritis, which also responded promptly to artificial fever. No other form of treatment was employed in these cases. All the children tolerated the treatments well; none were injured in any way by the artificial fever treatments. — [Abstr. J. A. M. A. **109**:2020 (Dec. 11) 1937.]

Physical Treatment in Brucellosis. L. Feldmann.

Brit. J. Phys. Med. **12**:157 (Nov.) 1937.

Our patients were treated at first in other hospitals and were subsequently referred to us at the Research Institute at Tashkend, Russia. Out of sixty-eight patients with brucellosis, 48 were treated with general diathermy. In nine cases the improvement was considerable, in 32 it was moderate, and in seven no change was recorded. The forty-one cases showing improvement were of the "reactive" form of brucellosis, i. e., with cellulitis during the period of development without coarse changes in the visceral organs or affection of the peripheral nervous system. The results were not so good in the thirty-two cases with widely-spread cellulitis, peri- and para-arthritis, some enlargement of the lymphatic glands, participation of liver and spleen and to some extent of heart and blood vessels, changes in blood, etc., and pronounced affection of meningo-cere-

bral character. Still this group, in spite of the presence of anatomical changes in different organs and systems, was capable of a certain amount of improvement. Finally the seven cases not showing any improvement were those with lesions of the central nervous system, and visceral organs were unaffected by the general diathermy.

Out of nine cases treated by ultraviolet rays, improvement was noted in four, in which we probably had the anaesthetic effect of this method. The material received by us nevertheless shows us that the original data on which we decided our therapy, proved absolutely correct.

Experiences in Treatment With Radium in Cases of Malignant Tumors of the Upper Respiratory and Alimentary Passages With Regional Metastatic Involvement of the Lymphatic Gland. (Radiotherapeutische Edfahrungen bei bösartigen Geschwülsten der oberen Luft-und Speisewege mit regionären Lymphknotenmetastasen). A. Pagani.

Strahlentherapie **59**:575 (August) 1937.

Mesopharyngeal neoplasms are conceived by the author as originating from the soft palate and uvula, the tonsils, the base of the tongue, from valleculae, and from the lateral posterior mesopharyngeal wall. The most efficient treatment of this form of malignant tumor is not limited to any specific form of radiation but rather to an intelligent application by means of prolonged fractional roentgen therapy, or radium, often associated with electrosurgery. Pagani advocates prolonged fractional x-ray therapy for the primary and the involvement of the lymphatic glands. Electrocoagulation and radio-puncture is advised for localized non-metastatic growths of the soft palate, but equally good results were obtained with fractional x-ray technic. Summarizing his results, the author showed that he was able to obtain with prolonged fractional x-ray treatment 25 per cent, and 3 years to 21 per cent, and 5 years freedom from symptoms in conditions involving the lymphatic glands. The end result depends on early diagnosis and the virulence of the disease.

On Ray Therapy of Keloid. (Ueber die Strahlenbehandlung der Keloide.) W. Baensch.

Strahlentherapie **60**:204 (Oct.) 1937.

For keloids the author suggests treatment with radium as first choice, this to be used in the form of radio puncture, combined with irradiation applied at a distance. The procedure is equal to the one used with malignant tumors. As a rule 1 milligram was emitted per 1 cubic centimetre. The needles were introduced directly into the mass and passed below as far as reached by the keloid, (beware of treating too superficially!). According to the extent of the process, needles are used containing 1.2 and 4 milligrams and at a length of 1.2 and 4 centimetres. The filtration of the preparation is 0.5 platinum-iridium. When irradiation at a distance is the objective, radium preparations containing 5-10 milligrams filtered with 0.5 platinum-iridium are distributed over the surface of the keloids. The distance is about 1 centimetre. Good cosmetic results were obtained by that form of therapy in 36 per cent, extensive improvement was produced in 83 per cent; 17 per cent of the cases did not react. Though x-ray treatment proved equally successful (cosmetically) in 36.6 per cent, improvement was noticed only in 68 per cent, while the number of refractory cases amounted to 31.8 per cent.

Physical Basis of Ultra Short Wave Therapy. H. Rajewski and H. Schafer.

Deutsche med. Wchnschr. **63**:1065 (July 9) 1937.

Electric current produced by short waves is broken up in the body into a conducting current and a displacement current. The conducting current produces heat, and is independent from the wavelength. The power of the displacement current is universally proportionate to the wavelength. The principle of selective heating does not apply to the human body. The electrical conductivity of the tissue depends upon the microscopic structures of the cells. Experiments showed that the shorter the waves the better the therapeutic results. The most favorable are short waves of three meter wave length, but as yet instruments generating such short waves can not be obtained for clinical use. It is probable that ultrashort wave will be used eventually for diagnostic purposes. Further developments in the field of short waves will extend their applications to therapy as well as to diagnosis, thus adding a new chapter of biophysical research for practical use in medicine.

G. Davidsohn.

Use of Fever Therapy With Children. Murray B. Ferderber.

Pennsylvania M. J. **41**:354 (Feb.) 1938.

Sydenham's chorea is a fairly common childhood disease in which the pathologic and bacteriologic changes are still subjects of controversy. In spite of indefinite findings, hyperpyrexia offers some help. There is greater danger of undertreating than overtreating choreics. Patients that received less than 15 to 18 hours of fever between 105 and 106 F. were symptom-free from 4 to 6 months, but gradually lapsed into their former state of involuntary movements, restlessness, and irritability. Those who received from 8 to 10 treatments of no less than 3 hours each improved so that they are now classed as healthy, normal children, assuming, of course, that there is no permanent cardiac complication. A child with carditis appeared at first to be unsuited for hyperpyrexia, but even with a high pulse and respiratory rate during treatment, no complications developed.

The routine preparation of a choreic for fever treatment as suggested by Dr. McCormick is as follows: Assuming a diagnosis is correct, sedatives are prescribed for rest, and salicylates are

administered to tolerance before and after all foci of infection have been removed. Breakfast is omitted and a small dose of barbiturate is given on the morning of the treatment. It was observed that a rapidly raising of the child's temperature to its optimum was not satisfactory because the patient's psychic and physical status did not accommodate itself to sudden changes in environment very readily. It was frequently necessary to give additional sedatives during treatment, a situation experience with opiates in children under age 12 has not been which was neither pleasant nor satisfactory. Slow, shallow respirations, cyanosis, and even necrosis from opiates are not conducive to the operator's peace of mind. Barbiturates in small doses have been given with satisfactory results in many cases.

Electro-Coagulation Treatment for Inoperable Carcinoma of Rectum. Warner F. Bowers.

Nebraska M. J. **23**:41 (Feb.) 1938.

An elaborate instrumentarium is not necessary in employing cauterization for carcinoma of the rectum. There are a number of courses which may be followed in employing cauterization for rectal carcinoma. In most instances, it is possible to cauterize the lesion without the necessity of establishing a colostomy. This is applicable in cases of partial obstruction where proximal distention of the bowel is not a factor. In cases where there is complete occlusion of the lumen with symptoms of intestinal obstruction and distention, some type of decompression is necessary before cauterization can be used. The surgeon must decide whether he expects to use the method of total or fractional cauterization. In total cauterization, an attempt is made to destroy all of the tumor in one sitting while in fractional cauterization, an adequate lumen is established by coagulation and the patient then is frequently examined and when stenosis again is present, further cauterization is done. This type of procedure can be employed even in patients who are very poor operative risks due to advanced age or some other organic condition. From what has been said the author feels that cauterization, if employed in selected cases, relieves the pain and discomfort attending inoperable carcinoma of the rectum. The procedure often obviates the necessity for establishment of a colostomy and so commends itself to the patienf. It may be used in patients who cannot tolerate wide excision and multiple stage procedures may be done if required. The procedure is simple and satisfying if ordinary skill and common sense are employed.

Artificial Fever as Adjunct in Treatment of Neurosyphilis. Norman N. Epstein.

Arch. Dermat. & Syph. **37**:254 (Feb.) 1938.

In conjunction with drugs, fever therapy was administered to all the patients in the series. An effort was made to give each patient a series of ten weekly treatments, each consisting of five hours at a temperature of approximately 40 or 40.5 C. (104 or 105 F.). No patient is included in this series who did not receive at least four treatments totaling twenty hours. The number of hours of fever for the entire group of eighty-seven patients was 4,720, or an average of 54.2 hours for each patient. Four patients had received malaria therapy previously, but results had not been satisfactory. The clinical response in cases of dementia paralytica was satisfactory. The best results were obtained where the serologic reactions of the spinal fluid became normal, although in several in which the changes in the spinal fluid were not marked considerable clinical improvement was noted. An excellent clinical response was noted in eight tabetic dementia patients. In five of these the results of serologic tests paralleled the clinical results; in two patients there was no change, while in one a moderate improvement occurred in the spinal fluid. Cessation of convulsive seizures, relief of lightning pains, improvement in gait and ability to resume a gainful occupation were the criteria which served as a guide in the evaluation of the clinical response.

The clinical response in tabes doralis did not parallel the serologic response. Reversal of the reaction of the spinal fluid was not always accompanied by symptomatic relief. The clinical result was considered excellent in eight patients; moderate clinical improvement was noted in six; there was slight improvement in four; and no relief of symptoms was experienced by six. Pains of various types, mainly shooting, were noted by eighteen patients. All had complete or partial relief of pain during the period of fever therapy. This relief was permanent in eight, while in the rest the pains recurred after weeks or months to a greater or less extent. It was seldom necessary to administer narcotics to any of this group treated by this method. Some decrease in ataxia was noted in five; in one, however, was the gait restored tonormal.

Of the ten patients with meningvascular syphilis, three were asymptomatic. The remaining seven experienced marked improvement in general health.

Changes in Infra-Red Photographs Taken During Treatment of Varicose Veins. Earle E. Wilson.

Am. J. Surg. **37**:470 (Sept.) 1937

Infra-red photography visualizes superficial veins, visible and concealed varicosities, and venous dilatations due to obstruction. This suggested that infra-red might afford a satisfactory index of the progress of treatment of varicose veins by showing changes in the appearance of the vessels corresponding with the obliteration of the varicosities. To determine whether clinical progress is accompanied by changes in the infra-red picture, a number of cases were photographed at intervals by infra-red and conventional technic.

The information drawn from this study re-

sulted in the formulation of the following conclusions:

Changes in serial infra-red photographs do not necessarily parallel the findings obtained by clinical examination of varicose veins under treatment. The infra-red photograph may fail to demonstrate satisfactorily large veins of immediate clinical significance. Consequently, it may fail to demonstrate the obliteration of these veins after treatment. The persistence, after otherwise successful treatment, of small tortuous veins in the infra-red picture and which are not demonstrable clinically, may be a determining factor in the prognosis and permanency of "cure." The thickness of the skin overlying the vein, the thickness of the vein wall, and the size of the vein are determining factors in the infra-red visibility of superficial veins. The same factors which influence the infra-red visibility of varicosities must be considered in the evaluation of the infra-red photograph as an index of the therapeutic progress. The value of the infra-red photograph of varicose veins might be enhanced by the use of stereoscopic infra-red pictures. This would give a "third dimension" and might give valuable information concerning the venous circulation at different levels in the skin.

Fluorescence Microscopy on Living Virus With oblique Incident Illumination. F. Himmelweit.

Lancet **2**:444 (Aug. 21) 1937.

In fluorescence microscopy two methods of illuminating the object are available; firstly, by means of a suitable substage condenser and, secondly, by oblique incident illumination.

Modern Surgery of Retinal Detachment. Harry S. Gradle, and Samuel J. Meyer.

Surg., Gynec. & Obst. **66**:380 (Feb. 15) 1938.

Modern electrosurgical treatment of retinal detachment consists of several well accepted methods which have stood the trial of experience. Today it is merely a question which of the technics utilized renders greatest service. Electrocoagulation by conventional diathermy offers two approaches: (1) surface coagulation with blunt electrodes, and (2) electropunctures with production of coagulation of the choroid. The former method was introduced to produce extensive retinochoroiditis which resulted in closing of the tear. The latter one is associated with Weve's studies of the electrocoagulation over the region of the tear. The revival by Vogt and Imre of the 19th century method of treating retinal detachment by electrolysis, called katholysis has brought to the fore a method based on long established clinical facts.

In favor of katholysis is the precision with which its effect on the ocular tissues is circumscribed. There is no extensive spread of the current and on this account no damage is inflicted on other intra-ocular structures remote from the area of operation. After katholysis there are usually not seen any complications such as cyclitis, iritis, cataract, and optic neuritis which follow in some cases in retinal detachment treated by any one of the surgical diathermy procedures. Another advantage of katholysis is its value in localizing the site of the retinal tear. At the point of insertion of the negative electrode through the sclera and choroid, a string of hydrogen bubbles about 2 to 3 mm. long is to be seen, easily recognizable on ophthalmoscopic examination; these bubbles afford an important mark of the relationship of the puncture to the site of the retinal tear.

Infra-Red Photography in Diagnosis of Vascular Tumors. F. Ronchese.

Am. J. Surg. **37**:475 (Sept.) 1937.

Infra-red photographs are obtained with an ordinary clinical camera, special infra-red plates, a special filter, and an incandescent tungsten filament lamp (500 W.), with an exposure time from three to five seconds.

Further details of technic and references can be obtained from the papers of Haxthausen, Massopust and others. Ronchese concluded that infra-red photography is a valuable method of investigation in the diagnosis of vascular cutaneous tumors in the living, when the presence of blood is doubtful.

Short Wave Treatment During Childhood. W. Matheja.

Kinderärztl. Praxis **8**:453 (Nov.) 1937.

Matheja demonstrates that in all non-specific inflammations of the cervical lymph nodes the results of short wave treatments are more rapid and more reliable than is the case in any other form of treatment. No difficulties are encountered in the ambulatory treatment of the glands. The main effects of the short wave treatment are rapid disappearance of pain and fever, improvement in the general condition and cure. The course of the process of recovery is dependent on the duration of the glandular inflammation. New glandular swellings, in which the treatment of short waves is begun early, are quickly absorbed. Cases of adenitis that have existed for longer periods break down more rapidly under the influence of the short waves and can be subjected earlier to surgical treatment. In the presence of chronic nodules of the cervical lymph nodes and in case of specific, particularly tuberculous, adenitis, the treatment with short waves is ineffective. However, its effects are especially favorable in children with cutaneous and subcutaneous hematomas and in the deep lying abscesses. In otitis media the results were not favorable; only the acute forms responded somewhat, but even here the short wave treatment could not be relied on, for it failed in a number of acute otitides. In chronic otitis media there was no effect whatever. Good results were obtained with short wave therapy in a case of pleural empyema, but reports in the literature indicate that such favorable results cannot be expected in all cases of this type. — [Abst. J. A. M. A. **110**:321 (Jan. 22) 1938.]